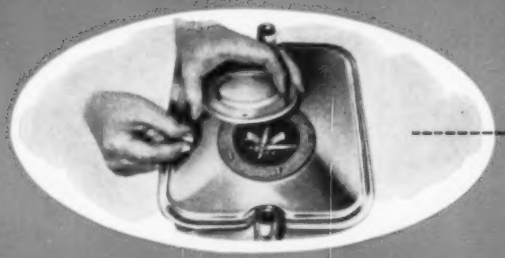
NOVEMBER 1957

GAS

Odorization techniques in New York City

A CHILTON PUBLICATION

New Advanced Design AMERICAN® "W" Series Steelcase Meters



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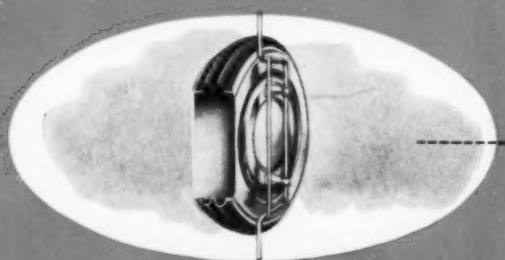
Interchangeable Index—external and isolated from pressure with gas-tight frictionless rubber grommet drive-shaft seal.



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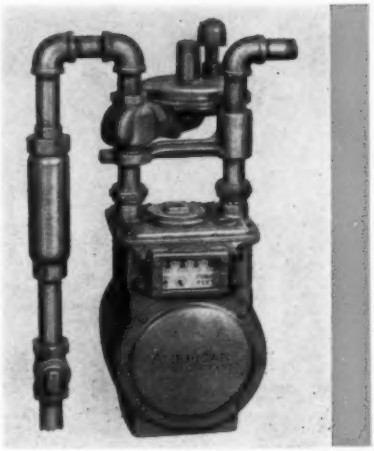

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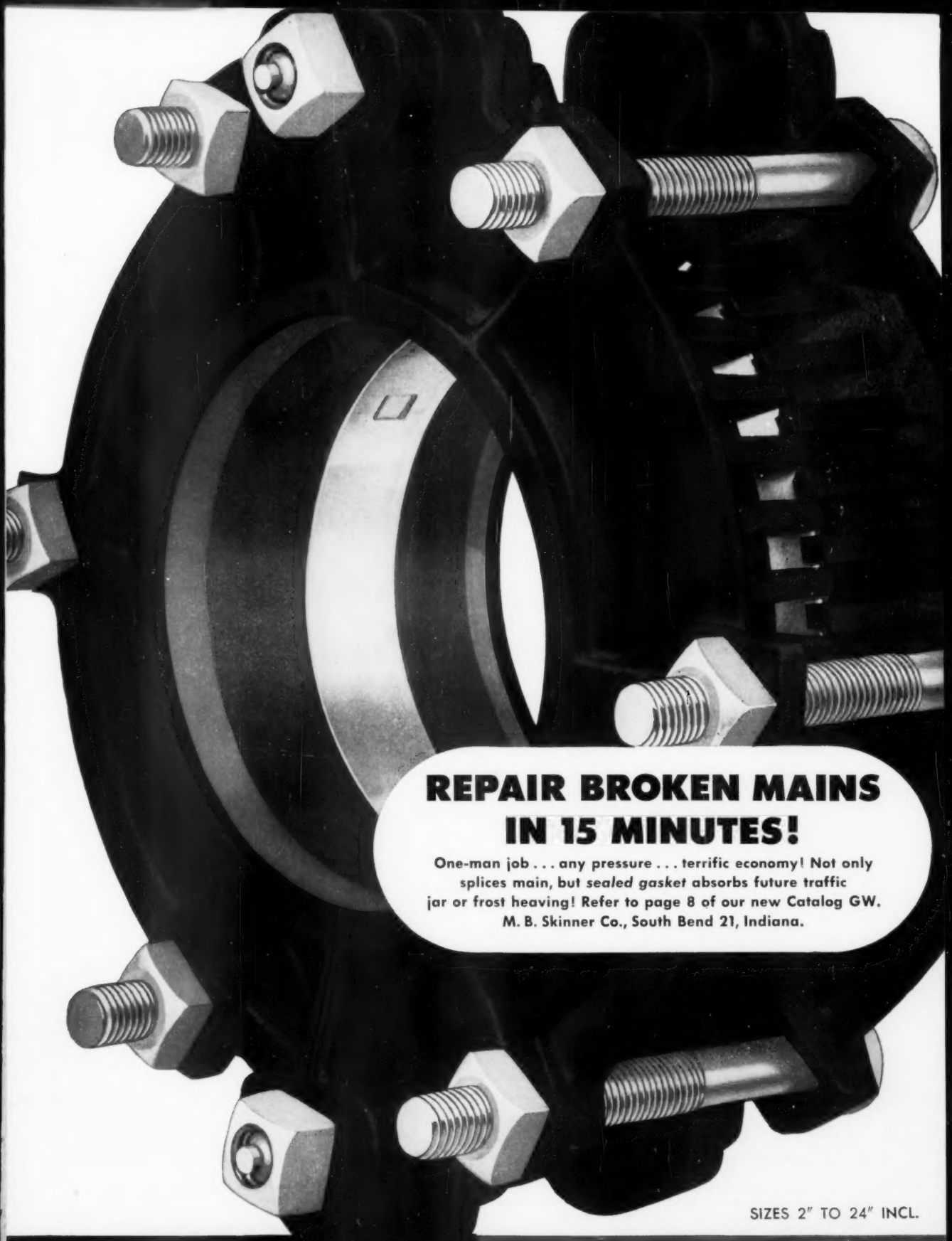

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EPA

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The underground storage technique deserves your careful consideration. You can get detailed information on National Seamless Steel Bottles by writing to: National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

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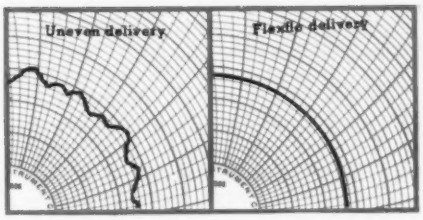

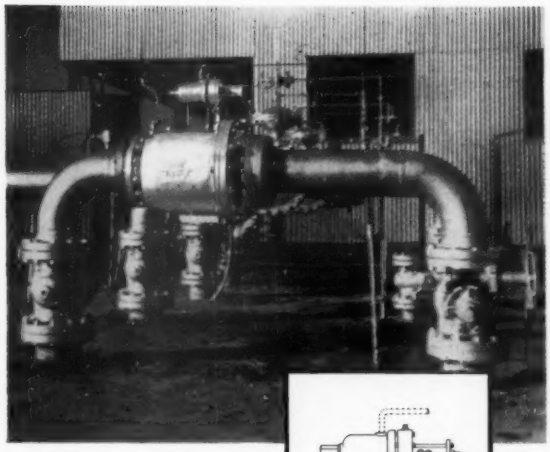

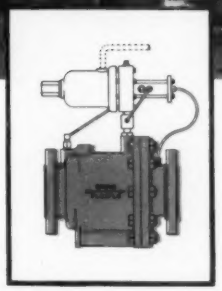

A model 80-280 Grove Flexflo Pressure Reducing Regulator with spring loaded pilot, reducing from 450 to 125 psi.

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Watch that meter pen settle down to a steady record! Flexflo's unique operating principle results in pressure reducing performance that just can't be matched by any other regulator. Basically a diaphragm-operated valve, the only moving part is a flexible yet tough expansible tube, serving as *both* diaphragm and valve. These regulators have proven themselves more sensitive and positive acting; longer lasting in countless punishing installations. And Grove pilots, carefully selected for specific requirements, are engineered to coordinate with Flexflo valves.

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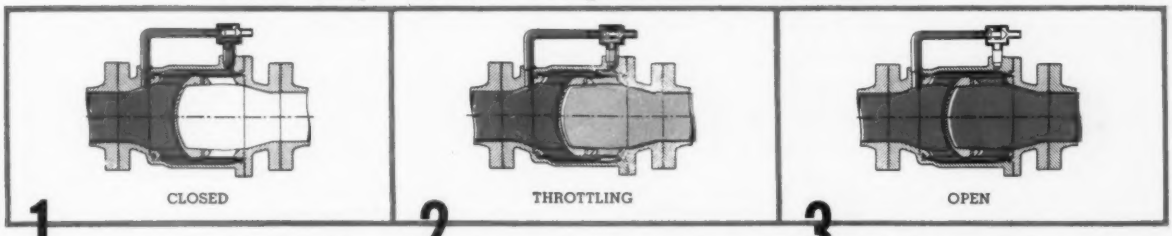
Here's why: *flexflo* lets pressure do the work--



1 The only moving part in the Flexflo Valve is a tough Buna N tube stretched over a cylindrical slotted metal core. When closed, line pressure from within, tending to force tube off core, is opposed by equal jacket pressure. Tension of the tube itself forms a positive, bubble-tight seal. The tube conforms to uneven surfaces and is hence unaffected by foreign matter or erosive wear.

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GAS Thermally Thinking

THERE are some mighty fine people in the public relations end of the gas business. Such chaps as Steve, Doug, Dan, Van, Ken, Art, Bill and Conrad are good public relations types and pretty cozy characters. Besides, I have article clearances pending with these lads, so do not feel that this is a propitious moment to harpoon them anyway.

Mr. Average-Gas-Company-Public-Relations-Man leaves me mildly pretty cool, at times. He does a pretty good job internally. Thus, like our sister oil industry, the gas industry does a fine job of convincing itself. But even the employee relations do go astray and tend to circle. The classic example here is the gas company program that is given the top secret label. It bounces around among the P/R and management hierarchy, becoming more hush-hush as it treks. The employees pick it up on their precisely-tuned rumor frequency, analyze it, and file it among their memoirs for comfort in later life. After the program has completely lost the golden touch of timeliness, it is presented to the force who, by this time, couldn't care less. This type of operation reminds me of around-the-corner straights I insist on backing—on occasion—at small, informal card games.

Now we turn our analysis to the point of view of the public. Right now Mr. Public's interest in the gas industry seems limited to a review of the newspapers to see if his local gas company has received this week's rate increase. If not, he turns his attention to more mundane matters such as the Little Rock situation, the Scotch-on-the-rock situation, etc. If his gas company did get that rate increase, he immediately concludes that Texas millionaires and some fancied international petroleum cartel have joined hands, compromised the Congress, have three FPC commissioners in their pockets, and have ordered a new putter for Ike—all of this nefarious activity is designed, of course, to surreptitiously raise his gas bill by 18 cents per month.

We tacitly admit these allegories are a bit heavy. But, have you discussed gas rate increases with your neighbors lately? I have and it's rough. Our industry needs these public relations people like we have never needed them before. The industry is heavily regulated. Regulation originates in, and in the final analysis is the extension of, the public mind. We need more than a few anemic press releases and a "mention" in the Wall Street Journal to "educate" that public mind.

Do your public relations efforts limit themselves to just your company? The gas industry's "big picture" also needs to be told. The public mind should know the gas industry's excellent story. I venture that the public really wants to know and evaluate for himself. Your next-door neighbor does, and the bird behind him does—how much more public can you get?

P. S.—Don't get all wrankled up, fellows, I do too *really* need those articles.

J. Fred Ebdon

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As a result, they recently traded their converted *farm-type* power-digger, for a new Case "320" *industrial* loader-backhoe combination. The Case unit was selected after a thorough competitive demonstration, because of its heavier construction, superior performance *and lower cost.*

Unit-cost per home reduced

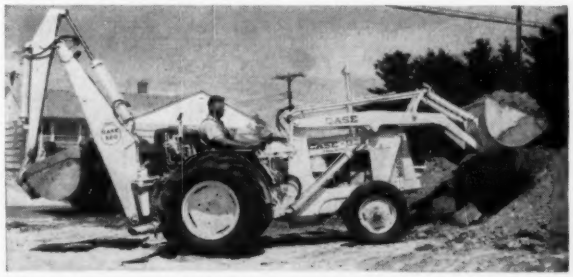
Company records prove the choice was a wise one because the Case "320" has already *cut the cost of digging and backfilling water service lines and sewer systems by 50 per cent.*

Says owner Harvey Lubov: "We've been able to greatly decrease our unit-cost per home for installing water and sewer systems. Because the Case backhoe has more power and is easier to maneuver, it can dig an average trench — 7 ft. deep, 3 ft. wide at the bottom, and 65 ft. long — in an hour and a half. We now complete *four* such installations per day, compared with only *two* per day with our former machine. We've also cut the time of installing septic tanks and drain fields by 33 to 50 per cent."

Handles utility jobs!

Lubov saves additional time and labor by using the "320" for various handy-man jobs. With the 13-cu. ft. hydraulic self-leveling loader, he loads trucks, lifts materials, cuts sidewalks and driveways, fine-grades and spreads gravel with the machine, instead of by hand. Says Lubov, "The Case rig is big enough to do a fast job, yet small enough so it doesn't damage new foundations."

You, too, can save money and increase efficiency with a Case "320" backhoe-loader. See your nearest Case Industrial Dealer today, or mail handy coupon below.



Lubov's operator says the high-speed Case shuttle transmission and "one-finger" power-steering are a big advantage on loader jobs. Wheels do not jackknife when turning, and the big tires do not "sink-in" under heavy loads, as former machine did. He also appreciates the ease of reaching all tractor-controls from the backhoe seat.

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GAS highlights

NOVEMBER 1957

SPOT NEWS, TRENDS, COMMENT ON GAS INDUSTRY AFFAIRS

The 39th annual convention of the American Gas Association had some tough competition this year in St. Louis. A World Series is pretty hard to bat against. Some of the sessions looked as if the Braves and Yankees won. But the some 2500 delegates managed to get some work done. And most of them were well pleased with the progress of the Braves who subsequently went on to take it all. Many gasmen were wondering what would have happened if the St. Louis Cardinals had won the National League flag.

Highlight of the big gas industry meeting was the "Shoulder to the Wheel" luncheon and meeting that wound up the affair on the afternoon of Oct. 12. There, a producer, a pipeliner, a distributor and an appliance manufacturer joined in words to explore ways and means of furthering gas industry unity. C. H. Murphy Jr., president of the Murphy Corp., El Dorado, Ark., gave the producers' side of the discussion. He said he feels the recent talks between the segments of the gas industry are very healthy. And: "If in these talks John Heyke has become convinced that he does not want to wade 40 miles into the ocean to drill a $2 million wildcat well that is more likely to be dry, then I stand persuaded that I don't want to face the ire of mythical Mrs. Brooklyn when her gas is cut off! We must be—and want to be—PARTNERS IN PROFIT." Mr. Murphy then traced some of the history of pricing and utilization of natural gas through the years. He said further, "The real reserve (of natural gas) is the vast and unknown amount of gas that nature has hidden throughout the earth's crust."

Paul Kayser, a pipeliner who needs no introduction to any segment of the gas industry, gave the delegates the point of view of transmission companies. Mr. Kayser leaned on the history of 2000 years ago in an analogy that leads him to the conclusion that—"Fighting between the component parts of the (gas) industry can only bring on scarcity of service, and if continued to the bitter end, starvation for this industry."

He pointed out that, first, the several parts of the industry must understand that gas must be found before it can be produced, and, second, the other components must understand that the distributor can be priced right out of the market. "The means for reconciliation of these ideas," said Mr. Kayser, "at present are: control and regulation by the Federal Power Commission." But, he was firm in stating that the regulation will not be successful if based upon the utility concept of a rate of return. "This concept can never, in my opinion," El Paso Natural's president said, "provide the incentive required to justify the risk inherent in exploration."

Speaking as a distributor, Marvin Chandler, president, Northern Illinois Gas Co., noted the trend of pipeliners and distributors to enter the fields of natural gas exploration and development. He believes in this and asked the question: "Won't more gas be found, or at least found sooner if more people put up more money to look for it?" And he said that we must not overlook the fact that sooner or later we will run out of natural gas. He called for vigorous efforts on production of a substitute by coal gasification. And Mr. Chandler mentioned that "all of us depend on the distributor maintaining its ability to sell gas in a competitive market."

In Marvin Chandler's opinion the biggest problem is sales. He feels the gas industry is now coasting on previously initiated momentum. He said, "Our kitchen and laundry appliances can beat what they (electrical equipment manufacturers) now have on the market, but are we preparing to meet what they will have 20, 10, or even two years hence?"

Stanley H. Hobson, Geo. D. Roper Corp.'s president, addressed the "Shoulders to the Wheel" luncheon as a gas appliance manufacturer. He mentioned a survey he had made for his company. It was conducted by a well-known engineering firm, familiar with utility people and companies. The survey revealed to his stockholders that the future of the gas range industry was irrevocably tied-in with the progress of the gas industry; and, the replacement of outmoded gas cooking equipment would be a lucrative market. The forecast showed a considerable growth pattern for gas utility and LPG customers. At the same time the market for replacement of old gas ranges was large. But, experience has shown that the growth in customers made in the forecast was accurate, but gas range sales failed miserably to hit its forecasted volume. He also pointed out:

"It seems to me that five years ago the gas industry did a lot of soul searching and recognized the then inherent weak points in gas appliance merchandising. We wrote a blueprint for improving our markets. We called this endeavor the ACTION PROGRAM FOR GAS INDUSTRY DEVELOPMENT. We put our 'Shoulders to the Wheel' five years ago —don't you think it's high time we started to push?"

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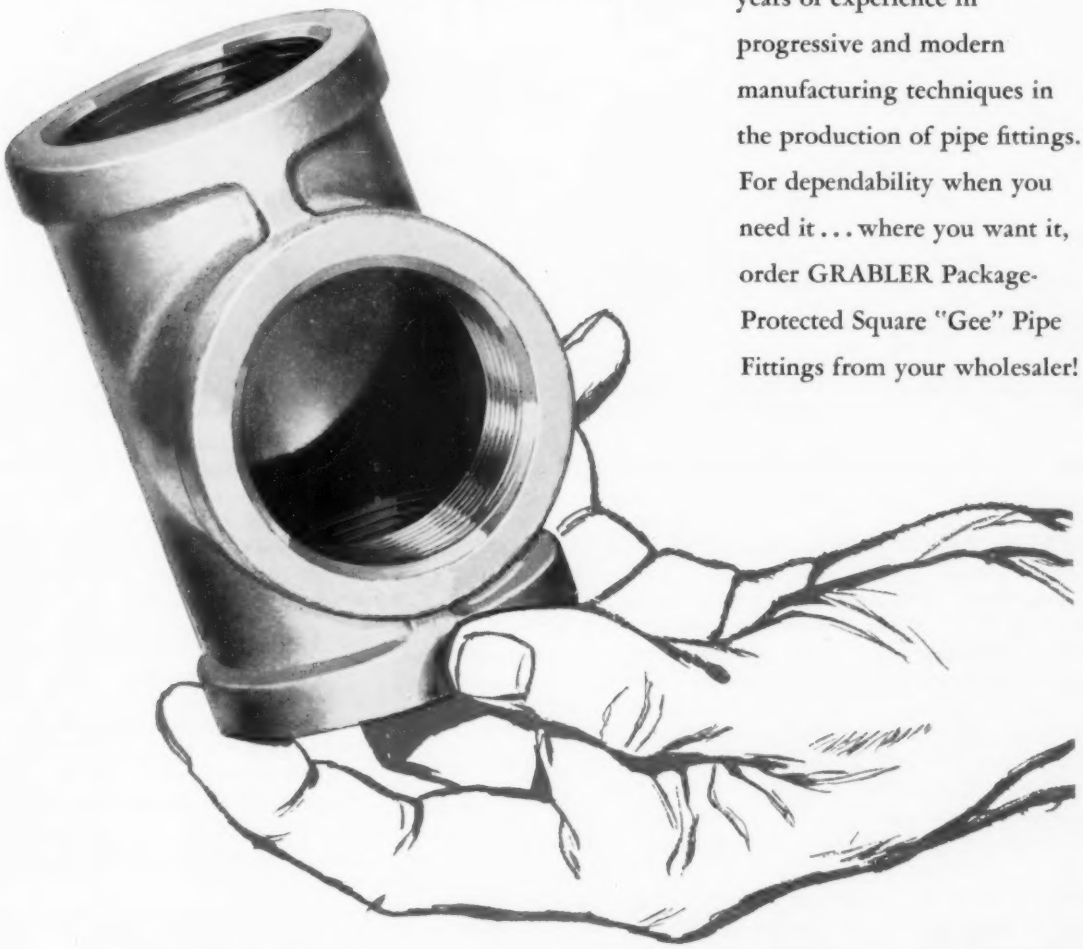

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*regulatory and legislative trends

Financial rocks and rate relief

A STATE regulatory commission recently denied a natural gas distribution company a requested temporary rate increase during a major proceeding. The temporary rates would have produced about $1 million more revenue yearly while the proposed final rates would have increased revenues by more than $6 million. The commission ruled that there was no financial emergency and that the entire evidence must be presented by all participants before rate relief could be justified or granted. Temporary rate relief then becomes limited to the unfortunate cases when the delay in the tide of the regulatory process has forced the utility's ship to a point dangerously near the financial rocks.

Earnings and delay

In a rate increase decision two years before, the commission had concluded that the gas company was entitled to earn a 6 per cent return on the rate base comprised of the depreciated original cost invested in its facilities. The revenues from the temporary gas rates were estimated by the company to restore its concurrent subnormal earnings to more than 5 per cent on the rate base. The commission's staff had forecast that the temporary increase would not cause the utility's return to exceed the 6 per cent found to be reasonable by the commission in the prior case. There is a harsh result from the commission's denial of temporary gas rate relief nine months after the main rate application was filed and with known additional delays to come. Justice would point toward a temporary rate increase to restore a utility to the earnings level approved by any commission in a former case, especially when the evidence showed that the cost of money had risen in the meantime. One of the recognized guides to finding what is a fair return to allow a utility to earn is the cost of bond and stock money.

Commission reasoning

The reasoning of the commission in denying the proposed interim gas rate increase may prove helpful to management in planning future rate cases, so let us review it. The public utilities commission noted the evidence of earnings, the fact that more days of hearing were scheduled to complete the evidence by others than the company, and then declared:

> "With full appreciation of the situation in which applicant is placed, there is no question but that the rates last heretofore authorized by the commission are presumed to be both lawful and reasonable until changed by the commission. Regulation does not guarantee a net profit to a utility, and before applicant is entitled to an increase in rates, it must accept and sustain the burden of proof justifying the increase. It cannot be fairly said that it has sustained that burden until all pertinent evidence has been received by the commission. The sought continuance of the winter rates, now scheduled to be decreased automatically on May 1, 1957, can be nothing but an increase in rates, and, it is noted, applies in the great part to the general service or domestic consumers. The commission is not permitted by law to be generous to a utility. The rates authorized by the commission must be just and reasonable only. It cannot be said that applicant is in an emergency or perilous financial condition. Whether applicant is entitled to the rate increase sought by its application, as amended, or any increase whatever, is immaterial at this juncture of the matter. That fact will be determined by the commission in orderly manner after all of the evidence has been received.
>
> "We therefore find and conclude and it is our judgment that applicant's motion should be denied.
>
> "This order shall not be construed as a final determination of any of the issues raised by the application, as amended, herein.
>
> "In view of the delays that have been occasioned in this matter to date, we direct that all closing statements shall be filed within 10 days after completion of the hearings in this matter."

The consequence of the commission's decision was to compel the gas company to continue to absorb an unrecoverable financial loss. When one realizes that the objective of utility regulation is to balance the interests of consumers and investors, one wonders about the weight given the investors on the scales in this case.

Commissioner Hooker of Virginia has expressed his philosophy on balancing consumer and investor interests. His viewpoint would help in other jurisdictions. He asserted to the NARUC:

> "Looking back over my some 30 years' experience in the field of regulation, particularly as to public utilities, it appears to me that it is important to keep one

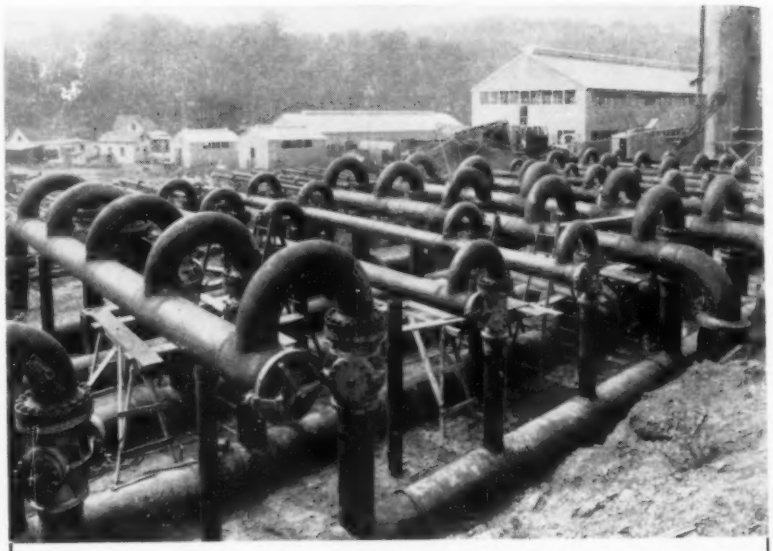
*A monthly commentary on national and state developments by an expert in the field of utility law.

central theme in mind in discussing this matter of consumer protection. That theme is simply this—it is necessary for regulators to take a balanced view looking toward stimulation of utility expansion and innovation rather than to prices and profits alone. This is necessary in the public interest and for the regulatory protection of the consumer.

"Moreover—and here is the point where regulation so easily can go astray — we must not lose sight of the fact that fulfillment of our obligation to the consumer can be achieved only when the utility is in a consistently sound financial position. I stress this because the customers interest is inescapably linked to the condition of the utility.

"One of our responsibilities, it seems to me, is to realize fully that regulation must have a long-range view. We do a partial job, and a poor job, if we think that regulation begins and ends with hammering down the rates which a utility can charge. All of us are familiar with the American fable which concerns the farmer who sought to save corn and hay by feeding his horse less and less, until the horse died. Well, if we want a utility to keep on working, we must supply enough 'feed.' Only a healthy utility can develop new services and get the capital to introduce the better service that the public interest requires.

"The commission that fails to see that the utility continuously receives a reasonable and fair return is not, in my opinion, properly protecting the consumers in the long run. The money that the impoverished company is compelled to borrow from time to time is secured (if obtainable) at a much higher cost than in the case of the company that has shown a consistently fair return over the years and is giving satisfactory service to the public it serves. These things cannot be accomplished when a regulatory commission only allows the utility a miserly return on its investment." ■



This maze of heavy tonnage piping constitutes the major marshaling yard for routing 83 billion cu ft annually through Manufacturers Light & Heat Co.'s Tri-State system.

Huge gate nest serves eastern area

A gate nest and related piping system, termed the "largest of installation of its kind in eastern United States," has been installed by Manufacturers Light & Heat Co., Pittsburgh.

The system was erected and fabricated by Dravo Corp. at Manufacturers new compressor station at Majorsville, W. Va., near the Pennsylvania state line.

Made of thick-wall seamless carbon steel, the gate nest will serve as a major marshaling yard for routing 83 billion cu ft of gas annually in the next three years.

Actually the system, designed by the utility's engineers, is so built that it can handle service demands at various pressures and volumes up to 400 MMcf/day.

The set up consists of five 24-in. underground headers, 11 aboveground crossover lines ranging in size from 12 to 20 in., 12 precision-bored meter runs, plus four pressure regulator settings and four heater settings. The piping links the new 5280-hp compressor station with Manufacturers' extensive system serving the Tri-State area of western Pennsylvania, eastern Ohio and the West Virginia Panhandle.

When completed, the new $3,485,000 station will take southwestern gas at a pressure of about 550 psi. After it passes through the gate nest and its related piping to the station, the gas pressure will be raised to 1200 psi.

Passing again through the gate nest, this high pressure gas will be carried to the storage fields.

This fall and next spring the new station will serve as an auxiliary to a nearby 2500-hp station built in 1909 to obtain native gas from the two fields now used for storage. This older station will be withdrawn from service next year and the larger station will assume full control of storage and gas relay.

To make the changeover in its service facilities, Manufacturers has extended its transmission and storage lines from the old to the new station, with all connecting to the larger unit at the gate nest.

Dravo prefabricated the entire job to the utility's design in its shops at Marietta, Ohio, and shipped it in sections to the job site as needed.

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Working pressures to 1200 p.s.i. on ¾" through 8" sizes
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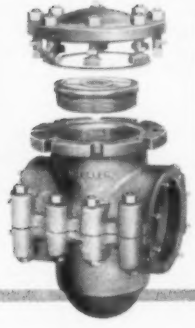

Mechanical Joint
Sizes 1" through 12"
Working pressures to 175 p.s.i.
For cast iron or steel pipe

Your Mueller Representative can furnish complete information on these fittings and the equipment with which they are installed. Contact him or write direct.

Isolate sections, relocate, repair or tie in copper, steel or cast iron lines under pressure. Mueller Line Stopper Fittings permit you to complete the entire operation under pressure in a safe NO-BLO® manner, without escape of gas.

All fittings are equipped with an internal threaded plug which closes the fitting and allows removal of all stopping equipment after the stop-off is completed. Fittings may be re-opened and re-used at any time, or if line is later abandoned, may be salvaged for use elsewhere.

An equalizing valve in the completion plug on sizes 3" and up equalizes pressure on both sides of the plug to permit easy insertion or removal under pressure. An "O" ring seal on the plug makes it completely leakproof.

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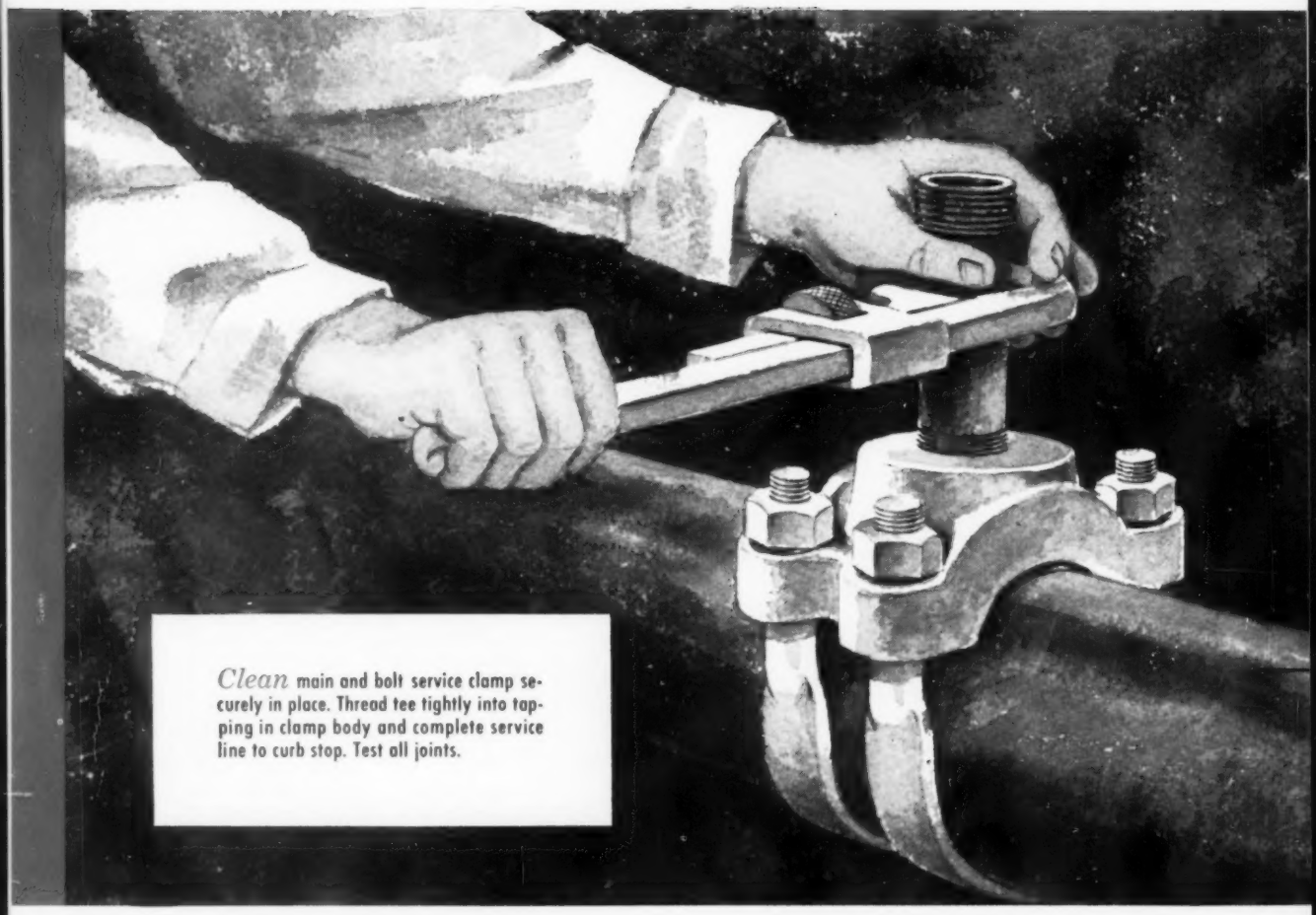

Clean main and bolt service clamp securely in place. Thread tee tightly into tapping in clamp body and complete service line to curb stop. Test all joints.

connect service lines to any type main *Safely* under pressure!

Attach gate valve to tee in open position. Mount D-4 machine on valve and drill into main. Retract boring bar and close valve. Remove machine.

Fasten inserting tool with completion plug, stem and bushing or stem (depending on tee used) to boring bar of D-4. Re-mount machine, open valve and insert.

Remove machine and valve. Tighten completion plug with wrench. Install completion cap to provide a double seal and test set-up. Connection is now complete.

Use NO-BLO® Service Tees, Valve Tees and Curb Valve Tees with Mueller® Service Clamps for fast, safe service connections to any type main.

Service clamps are available in single or double strap types for mains from 1″ through 12″ in size. Heavy galvanized bodies have thick boss with full length thread for maximum make-up and strength. Neoprene gasket is cemented in place for ease in installation. Cadmium plated forged steel straps are flattened for greater stability and resistance to corrosion.

Tees are available with threaded or compression outlets for steel service lines or compression outlets for Type "K" copper service lines.

All No-Blo Tees are also available with welding inlets and outlets for all-steel systems. A full line of hand or power-operated drilling machines is available for use with these fittings.

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Your Mueller Representative can show you how to save time and money on service connections. Contact him or write direct for complete information on how to connect services safely to any main without blowing of gas.

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A few applications of the 610 Auto-Point Computer

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•

Compressor State in Discharge Pressure Calculations

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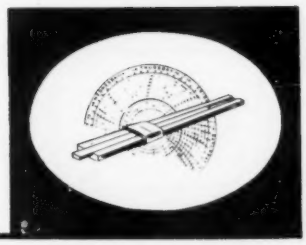
TIME EQUIPMENT • DATA PROCESSING • ELECTRIC TYPEWRITERS • MILITARY PRODUCTS

technical trends



By GUY CORFIELD

Low pressure polyethylene

Low pressure polyethylene is a newly developed type that is produced at substantially atmospheric pressures. The earlier conventional polyethylene required production pressures of several thousand pounds. The change has been principally due to improvement in catalysts that promote the union of ethylene molecules to form the polymer.

So far the new product costs about 25 per cent more than the old, but its properties are greatly improved and permit wider application. All the big names in plastic manufacture are already in production or developing new plants. And it is expected that the combined output of both types of polyethylene will soon reach 1 billion lb per year, perhaps as soon as 1960.

The low pressure process develops a very large or dense polymer molecule with few branched chains or double bonds. This gives greater physical strength and heat and chemical resistance: 4400 psi tensile strength as compared to 2000 psi; 260°F softening point as compared to 200°F; increased resistance to oxygen absorption; reduced gas permeability; and increased resistance to acids, alkalies, solvents and oils.

This type of polyethylene can be molded, extruded, cast, welded, flame sprayed, and machined. It is strong and tough. It can withstand immersion in boiling water and impact at freezing temperatures, and is practically inert to most gases, chemicals and solvents.

Its value as a piping material comes immediately to mind. Its cost is now relatively high, about 40 cents per lb. However, its resistance to corrosion and other deterioration is very attractive. It is said to be capable of withstanding relatively heavy earth loads. It can be joined by threading, hot gas welding, or insert and compression fittings. In this connection, a firm in England has developed a "resistance welded" method of jointing polyethylene pipe. The fittings, shaped for insertion of plain end pipe, have ribbon electric resistance elements molded flush with the inside surface. The pipe is inserted to butt against a shoulder. The leads from the resistance elements are connected to a 6-v heavy duty storage battery through a timing unit. The timer can be set for current flow and timed to provide the heat requirements of the various sizes and shapes of joints. When the weld is completed the leads are snipped off at the outside face of the fitting. This assertedly forms a strong and perfect joint with the nichrome heating elements sealed into the polyethylene so that they are not exposed to the fluid or gaseous contents of the pipe.

Standard for comfort air conditioning

The standards committee of the American Society of Heating & Air Conditioning Engineers has prepared a standard for comfort air conditioning which will shortly be made official by the society if no serious criticism comes from any other interested group. Essentials of this standard are as follows:

The *purpose* is to state the desirable air conditions for comfort for sedentary people normally clothed.

Comfort air conditioning is the process of treating air so as to control simultaneously its temperature, humidity, cleanliness and distribution to meet the comfort requirements of the occupants of the conditioned space.

For *Heating* (a) the *dry bulb temperature* at the 5-ft level should be within the range of 73 to 77°F, and the *relative humidity* within the range of 25 to 60 per cent; (b) excessive *radiant cooling effects* from surfaces which are considerably below the room air temperature should be compensated for by increasing surface tempertures, supplying radiant heating means, increasing the dry bulb temperature, or a combination of these methods; (c) the *relative humidity should* be limited to values which will not cause undesirable condensation on windows and in the building structure. With a relative humidity below 25 per cent, objectionable static electricity may develop, (d) The *temperature gradient* should not be more than 1°F per foot within the levels occupied by people.

For *cooling* the dry bulb temperature at the 5-ft level should be within the range of 73 to 77°F and the relative humidity should not exceed 60 per cent.

Regarding *air quality* (a) *outdoor air required*, where the only source of contamination is the occupants, is specified in a table in terms of smoking, whereby very heavy smoking as in a meeting room requires 50 cu ft per minute per person, and no smoking as in a theater, 7.5 cu ft per minute per person; (b) *contaminants* which should be removed by accredited methods are dusts, fumes, smokes, mists, fogs, vapors, deleterious gases, airborne allergens, and harmful bacteria or other microorganisms.

For *Air Distribution* (a) the *quantity and temperature* of treated air and the method of introducing it to the conditioned space should be designed to limit the variation in dry bulb temperature to 3°F at the 5-ft level throughout that portion of a single room which is normally occupied by people; (b) *air motion* exceeding 40 ft per minute should be avoided in the zone between the floor and 5-ft level.

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Oronite has its own odorant production facilities at two large manufacturing centers—Richmond, California and Oak Point, Louisiana—both located close to principal gas consuming areas.

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4459

WASHINGTON

Gas bill hits political trading circuit

by **NEIL REGEIMBAL**
GAS Washington Bureau

THE gas bill is being traded around the congressional political circuit like an over-age professional football star with maybe one good season left.

Trading time in the legislative league comes in the fall, when Congress is in recess. It reaches the heights in the fall of non-election years. This is such a year. The gas bill has become one of the most favored swapping baits in 1957, and by the time it's been kicked around the league a couple of times, the fading power of the bill may be completely gone, and the "one good season" dissipated.

The trading thus far has produced a budding alliance between two unlikely teams: The gas producers and the coal competitors, bitter rivals in most seasons.

The coal interests, and their spokesmen and supporters in Congress, figure they got a break when the gas bill people decided it was unwise to risk forcing the bill to a vote in the closing days of last summer's congressional session. The smoke and soot boys decided to use the time out to strengthen their team by making a deal with the principal supporters of the bill.

They found the opposition receptive. Backers of the Harris-O'Hara measure, although still talking bravely of victory next year [see the exclusive interview with Rep. Oren Harris (D.-Ark.), the bill's principal sponsor, on page 158 of the October issue], are more than a little worried.

The bill figured to pass the House if brought to a vote this year by only 25 or 30 votes. But many borderline congressmen who may have been willing to vote for the measure this year to follow party discipline, won't be so easily reached in an election year for a bill that has been labeled a "consumer gouge" measure. Thus, with the prospect of losing some votes, the gas industry needed some offensive power, and the coal people came along with an answer.

The swap being kicked around would amend the bill to include the so-called "coal amendment," giving the Federal Power Commission power to regulate direct pipeline sales to industrial customers. This doesn't figure to hurt the gas producers, but it would raise hob with the pipelines. If the trade is made, some pipelines have made it plain they'll oppose the measure.

The gas bill is also being used as bait for trades on other controversial legislation which will come up next year. The "you-vote-for-my-bill-and-I'll-vote-for-yours" boys are working hot and heavy in the locker rooms during the congressional recess. A few other minor changes in the Harris-O'Hara bill are thus also possible, but they won't have the importance of the coal-amendment if it is swapped into the measure.

Rep. Harris has reportedly suggested that the gas and coal interests work out their compromise quickly, so the word can be passed and votes lined up for speedy action when Congress reconvenes Jan. 7.

With the congressional picture more than clouded, an increasingly large number of gas industry spokesmen believe the issue will finally have to be settled by the courts.

The gas bill won't be the only headache the gas producers—and the rest of the industry indirectly—will have to face in Congress next year.

The tax depletion rate for oil and gas, now the highest of any resource at 27½ per cent, will come under strong fire. At the same time, however, other industries, particularly the coal, lead and zinc, and related mineral producers, will demand their depletion rates be raised.

Because each congressman has his own self-interest projects from his home district at heart, the trading here may produce a lot of talk, but when it's over, the outlook is for slightly higher depletion rates for other resources, but probably no reduction in the oil and gas rates.

One move that may succeed is a proposal by several western congressmen to limit depletion allowances to domestic oil and gas production. At present, a U. S. firm can claim tax allowances for depletion of foreign wells.

The coal interests are supporting an increase in the depletion from the present 10 per cent to 20 or 22½ per cent. Bills to accomplish this were dumped in the congressional hopper just before adjournment this year, and will be pending when congress reconvenes.

Most government officials, while supporting a full congressional review of depletion allowances, have backed the present rate for gas and oil.

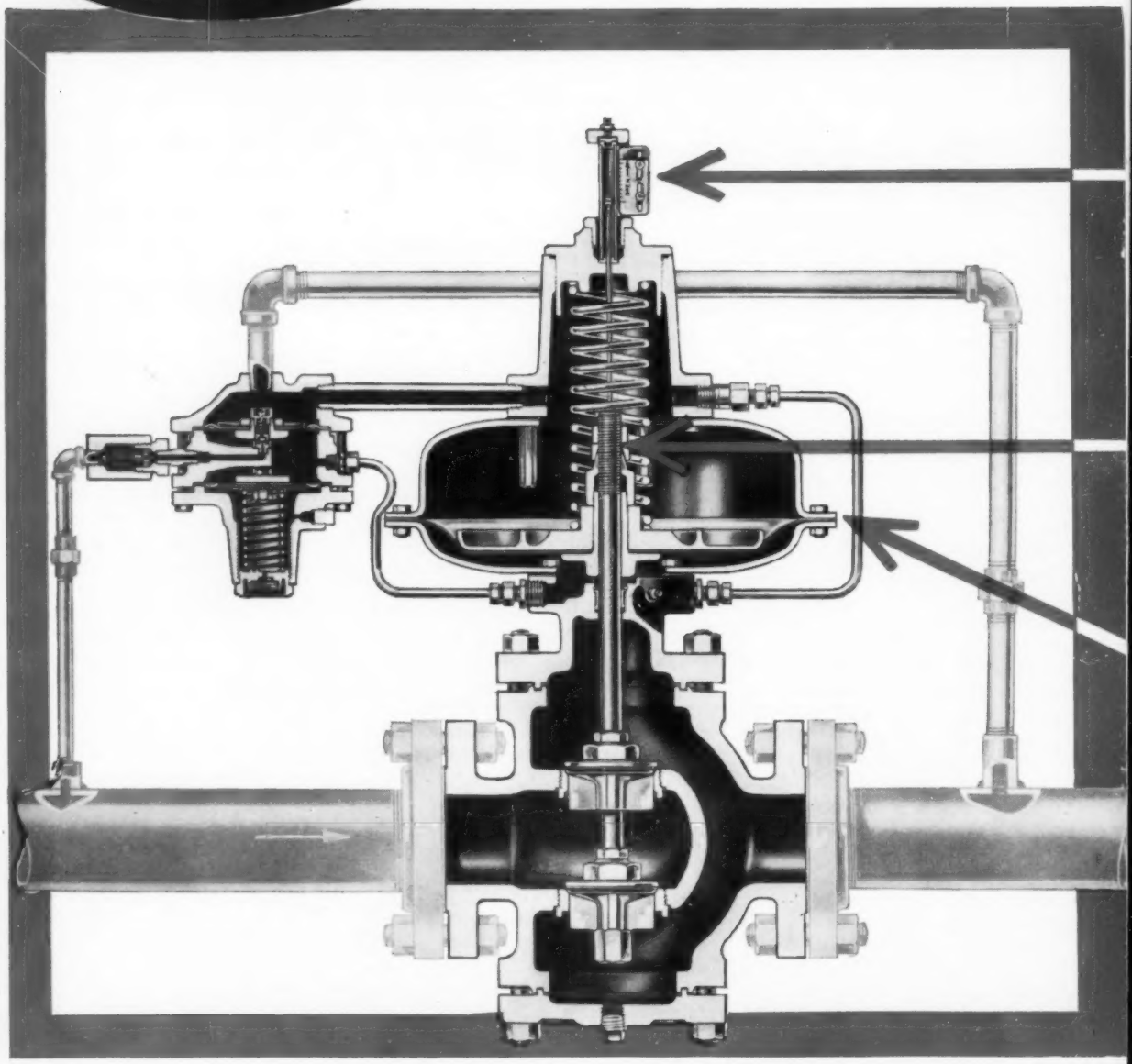
* * * * *

PAUL KAYSER's bid to combine his huge El Paso Natural Gas Co. and his latest baby, the sizeable Pacific Northwest Pipeline Corp., into one gas system is going to set a lot of legal precedents before the case is finally settled.

Continued on page 77

something NEW

FISHER® type 298T



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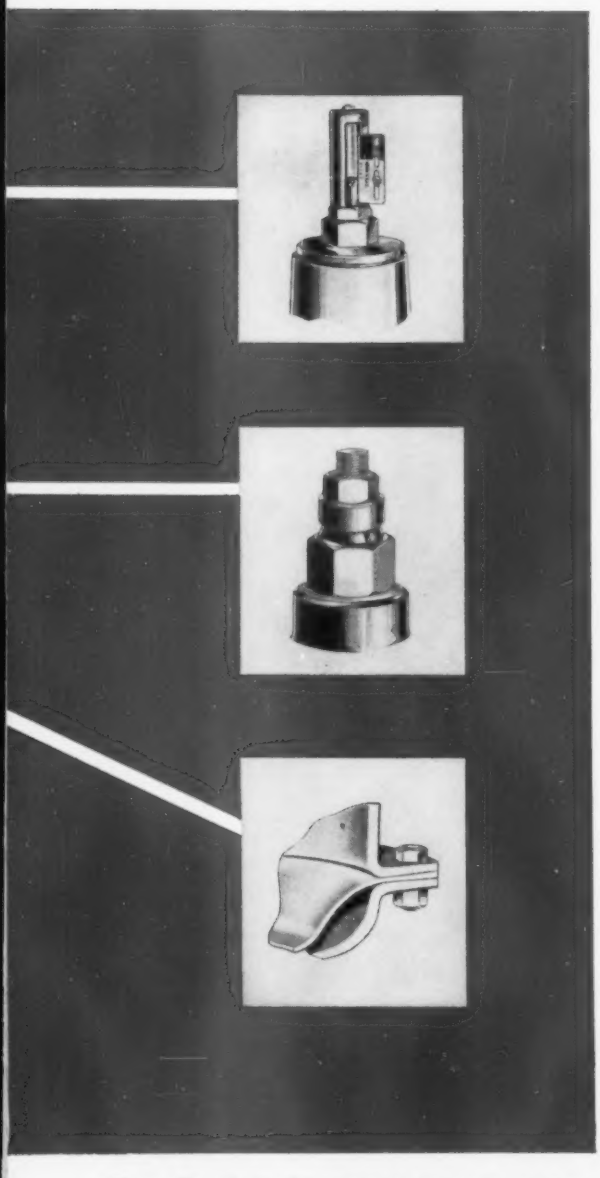
MARSHALLTOWN, IOWA

LEADS THE INDUSTRY IN

has been added!!!

gas regulator



The Fisher Type 298 which for so many years has been *the* gas regulator for district and industrial gas regulator service, now has these important improvements—

Now—A travel indicator* that shows valve position at all times, yet no stuffing box or friction causing seal is required. Note indicator is enclosed in glass away from dirt and weather. Glass tube is protected with rugged brass cap making glass breakage highly unlikely.

*(Optional equipment available at slight extra cost)

Now—A specially constructed tapered locknut on stem connection that refuses to let go—no possibility of inner valve spinning under high gas flows.

Now—Steel diaphragm casings of modern design for additional safety and adequate stroke for valves of all sizes.

And, the same reliable loading pilot and the other features that have made the 298 so popular among gas men are included in the new Type 298T. *Write for Bulletin P-298T.*

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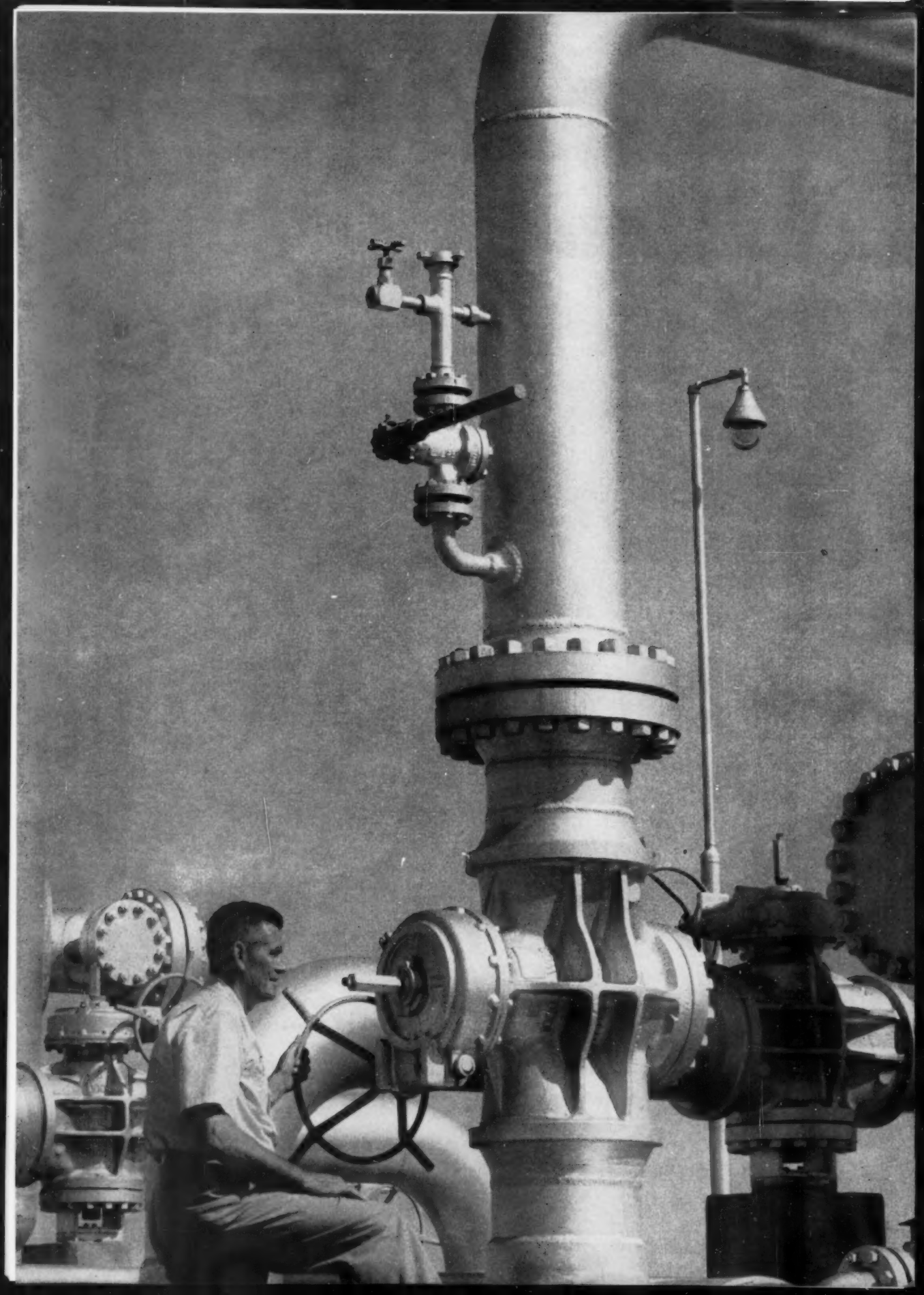

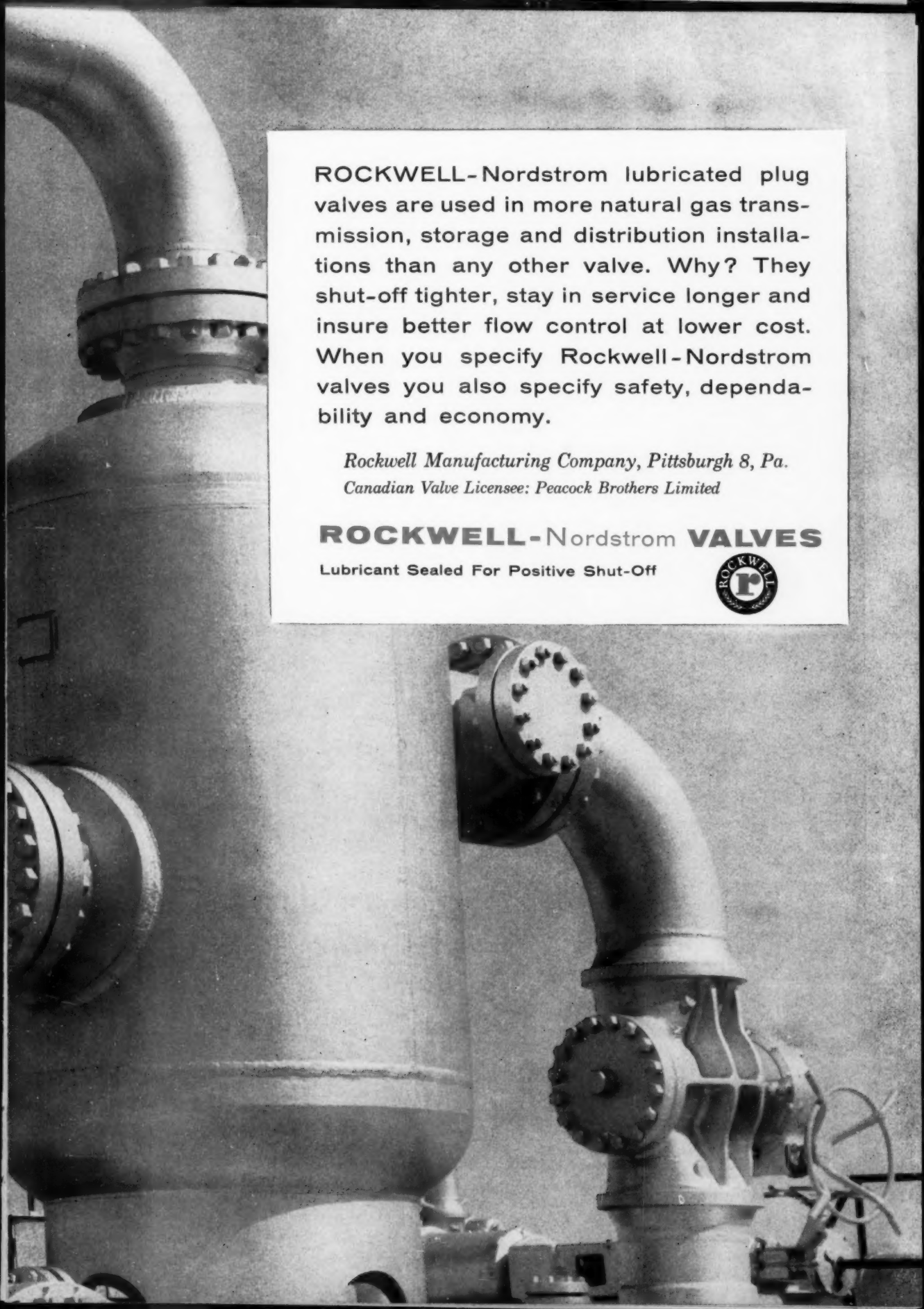

ROCKWELL-Nordstrom lubricated plug valves are used in more natural gas transmission, storage and distribution installations than any other valve. Why? They shut-off tighter, stay in service longer and insure better flow control at lower cost. When you specify Rockwell-Nordstrom valves you also specify safety, dependability and economy.

Rockwell Manufacturing Company, Pittsburgh 8, Pa.
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Lubricant Sealed For Positive Shut-Off

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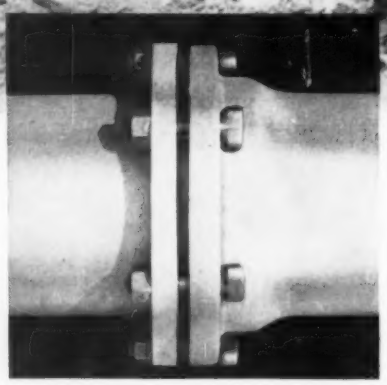


Richmond, Va.—Installing 12" Mechanical Joint cast iron pipe for Intermediate pressure natural gas main (25 psi).

CAST IRON®

Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, Suite 3440, Prudential Plaza, Chicago 1, Ill.

MECHANICAL JOINT **cast iron**

NOT THIS PIPE

Cast Iron Pipe Serves for Centuries!

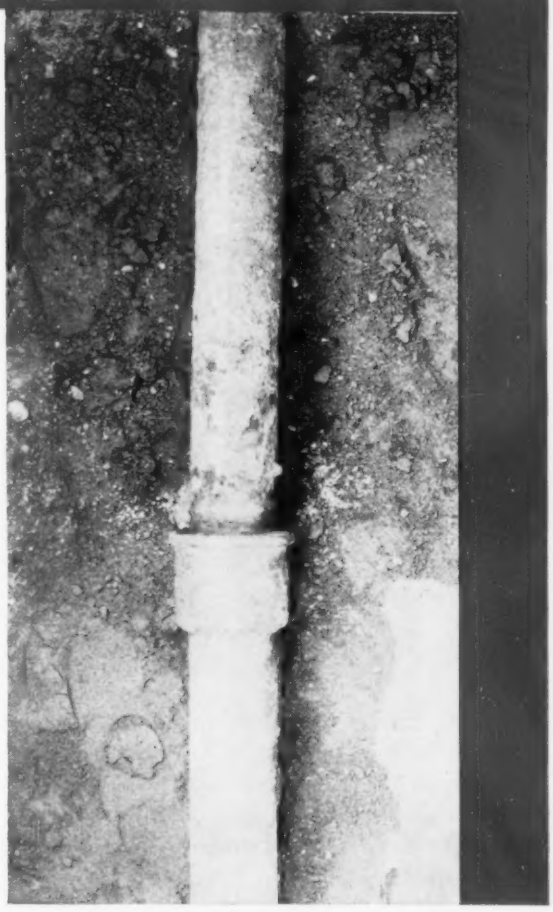
At the century mark, cast iron pipe is still going strong. The records of 40 American gas companies prove it. A hundred years and more ago, these companies installed cast iron gas mains. Those mains are still serving. Literally hundreds of others have passed the fifty year mark in service.

Today, *modernized* cast iron pipe, centrifugally cast, is even tougher and stronger. Its standardized mechanical joints are bottle-tight under all gas distribution pressures . . . and for all types of gas. Wall thicknesses are uniform. Joint design allows deflection during and after installation. Convenient lengths and full range of standard fittings to meet all conditions.

Cast iron pipe is easy to install . . . no special equipment needed.

And cast iron pipe is immediately available. No periodic shortages.

Specify cast iron pipe and centuries of proof back your judgment.



Over 111 years old this 4" cast iron gas main is still in service at Painesville, Ohio.

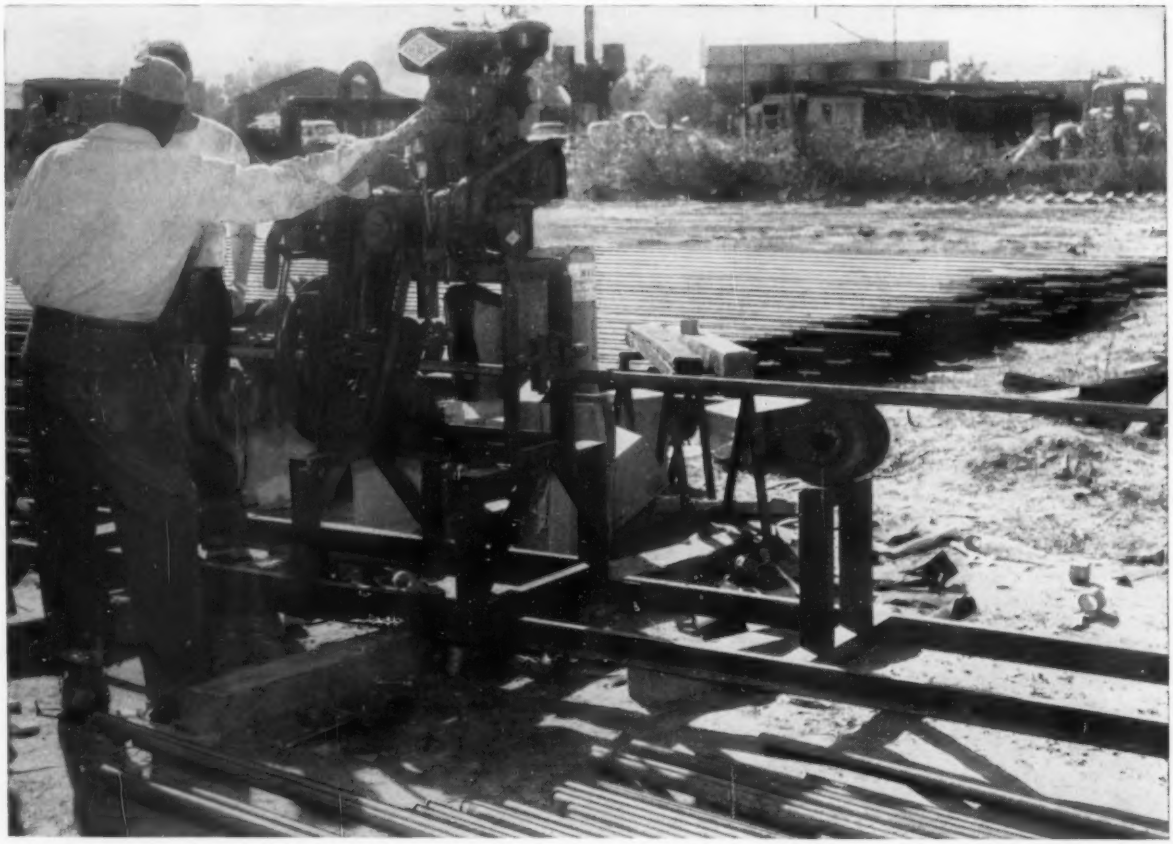
Nothing unusual about a record like this. Cast iron pipe is built to last. And today's *modernized* cast iron pipe is even stronger, more durable.

A FEW OF THE 40 GAS UTILITIES WITH CENTURY-OLD CAST IRON MAINS IN SERVICE

Peoples Gas Light and Coke Co., Chicago—Baltimore Gas and Electric Co.—Philadelphia Gas Works—Richmond Gas Works, Richmond, Va.—Hartford Gas Company, Hartford, Conn.

pipe FOR MODERN GAS DISTRIBUTION

Entire gas distribution system site-wrapped with Polyken tape



A simple, inexpensive, mobile assembly of cleaner, conveyor and wrapper—coats over 10,000 feet of pipe per day with Polyken Tape and overwrap.

Arkansas Louisiana Gas Company chose this method because it's fast . . . it's simple . . . it's sure

While *Polyken* tape is making big-inch pipeline news, gas companies are also finding it ideal for yard or site-wrapping small-diameter pipe in local distribution systems.

Such was the case here, when the Arkansas Louisiana Gas Company used The *Polyken* Method for an entire system including the two cities of Gould and Grady, Arkansas. The installation was made by the Worth James Construction Company, who has used *Polyken* tape on various jobs over the last five years.

In the words of Mr. James, the outstanding feature of this method is that "it eliminates the need for a hot coat plant for small projects."

Tough, durable *Polyken* is applied, as you see, right off the roll—without heat, liquids, solvents or thinners. That saves time, labor and equipment costs. Later, because of the extreme versatility of the tape, welded joints can be simply hand-wrapped.

Want to figure application costs on your job? Write, wire or phone: The Kendall Company, *Polyken* Sales Division, Dept. G-E, 309 W. Jackson Blvd., Chicago 6, Ill. (WEbster 9-7100).

Complete catalog, Sweet's Industrial Construction File, Sec. 31/Ke

Polyken®

PROTECTIVE COATINGS

THE KENDALL COMPANY
Polyken Sales Division

By MARSHALL E. PARKER

The prediction of leak rates—II

IN the pit-depth-time-area equation given in the last article,

$$P = kT^nA^a,$$

P and k are in mils, T is in units of 5.3 years, A is in units of 0.4 sq ft; n and a are exponents, and hence dimensionless. We wish to transform this equation, not only to more practical units, but so as to give us leak rates rather than maximum pit depths. We have

$$A = P^{1/a}k^{-1/a}T^{-n/a},$$

which gives us the total area associated with a maximum pit depth of P in time T; the units remain as given above.

If we set the maximum pit depth equal to the wall thickness of the pipe, the last expression will then give the total area associated with one leak in time T. It will also be found useful to change the time unit; to avoid an excessive number of decimal places in some of the tables to be developed, it is useful to express the time in units of 10 years. For a similar reason, we express the wall thickness W in inches instead of mils. We then have

$$A = (1.887)^{-n/a}W^{1/a}(1000)^{1/a}k^{-1/a}T^{-n/a}.$$

In order to get the total length of line associated with a leak, it is necessary to introduce the pipe diameter, and to use more conventional units for the area. Since

$$A = \pi D\, L/12 \times 0.4,$$

we have

$$L = (4.8/\pi)(1.887)^{-n/a}D^{-1}W^{1/a}(1000)^{1/a}k^{-1/a}T^{-n/a}.$$

The reciprocal of this expression will give the number of leaks per foot, and, if multiplied by 5280, the number of leaks per mile. Finally, then, we have

$$N = (5280)(\pi/4.8)(1.887)^{n/a}DW^{-1/a}(1000)^{-1/a}k^{1/a}T^{n/a}.$$

$$= (3456)(1.887)^{n/a}(1000)^{-1/a}k^{1/a}DW^{-1/a}T^{n/a}.$$

The three quantities k, n, and a are, as described in the first installment, characteristic of each particular soil. If we can successfully express each of them as a function of the soil resistivity, we shall have an expression from which it is possible to draw a prophetic leak curve for a given section of line lying in soil of uniform resistivity. When, as is normally the case, the resistivity is not uniform, we shall need to determine an effective resistivity for the section. It is probably true that, within limitations, the logarithmic mean resistivity is the correct value to use under such conditions; this question will be discussed later.

The next phase of the problem is that of determining k, n, and a as functions of the resistivity. When this has been done (and if it can be done successfully), we can then tabulate three factors as functions of ρ; for convenience, we will use the forms in which they appear in our last equation, and at the same time combine our various constants; we will tabulate

$K = (3456)(1.887)^{n/a}(1000)^{-1/a}\, k^{1/a}$,

1/a, and

n/a.

Then our expression will be

$$N = K\, D\, W^{-1/a}\, T^{n/a}.$$

The fact that we are using these factors k, n, and a in combined form rather than directly raises the problem of whether to attempt to derive them from the original data in combined form or separately. The latter procedure is the easier, but it is quite possible for a function of a variable to correlate more closely with the independent variable than does the variable itself. In other words, n/a might correlate with ρ better than either n or a alone. This can be tested by plotting n and a separately as functions of ρ and comparing this "scatter diagram" with the one obtained by plotting n/a. The same thing can be done with 1/a and with the more complex function which we have defined as K; this one involves all three of our original factors.

These scatter diagrams and the results of the various correlations will be presented subsequently. ■

'1200'

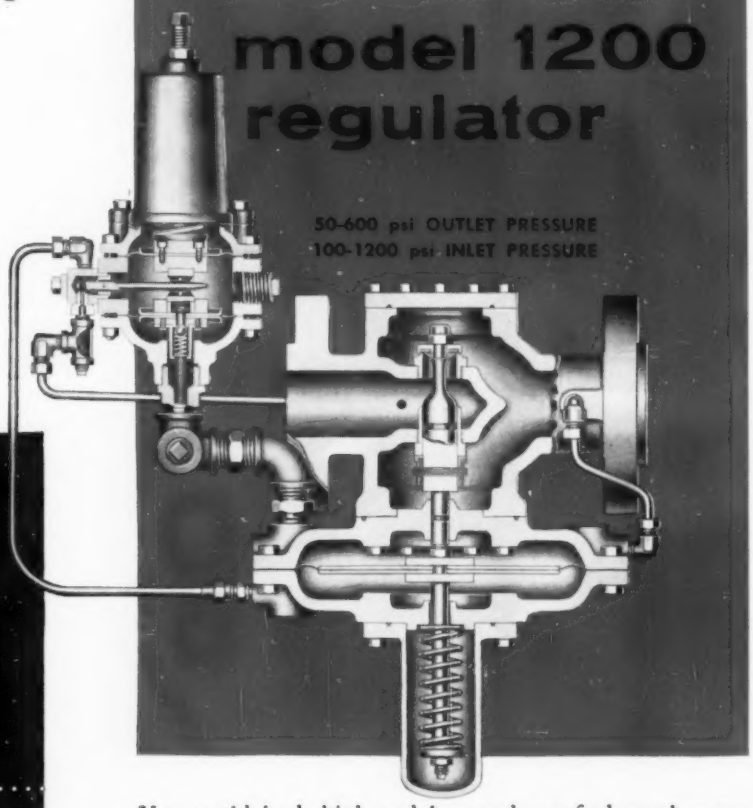
A good number to remember

gives widest range control... no other like it!

CHAPLIN FULTON

model 1200 regulator

50-600 psi OUTLET PRESSURE
100-1200 psi INLET PRESSURE



- Ready for installation . . . no field connections needed
- All-steel construction . . . stainless steel trim
- Pilot loaded for accurate control
- Large capacities 529,000 cfh at 800 psi inlet

SPECIFICATIONS

Single seat valve with molded in place disc—balanced against inlet pressure thrust.

Size—2" flanged Series 60 (Series 30 Optional)

Working Pressure—1200 psi (Series 30-600 psi)

Outlet Pressure

With Type 51 Pilot	50-150 psi
Type 52 Pilot	50-300 psi
Type 53 Pilot	50-600 psi

Face-to-Face

Series 60	10½"
Series 30	9¾"

for complete information write for bulletin 1200

You could look high and low and not find another gas regulator like this Model 1200 in the business. It's compact and self-contained, designed for rugged high-pressure service with Chaplin-Fulton accuracy. No field connections needed—a 2" integral unit ready for installation. Actually, this Model 1200 is an all-steel version of our widely accepted Model 1100 . . . now ready to help solve your high-pressure problems.

ACCURATE CF MFG CO DEPENDABLE

WSW 6834

Chaplin-Fulton

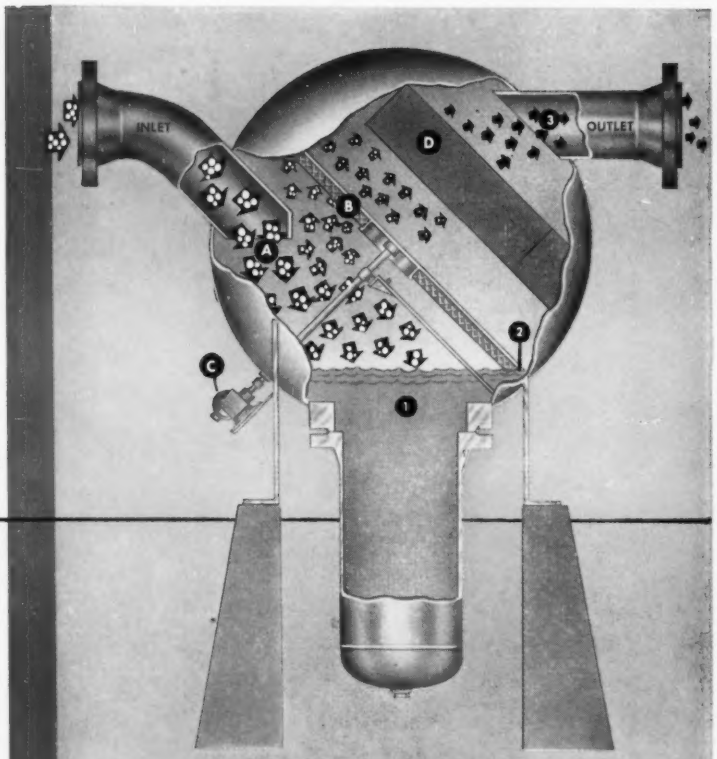
MANUFACTURING COMPANY

Pittsburgh 25, Pennsylvania

MORE EFFICIENT RESULTS!

PEERLESS SCRUBOSPHERE*

*Spherical scrubber for dust and liquid removal from gas flow

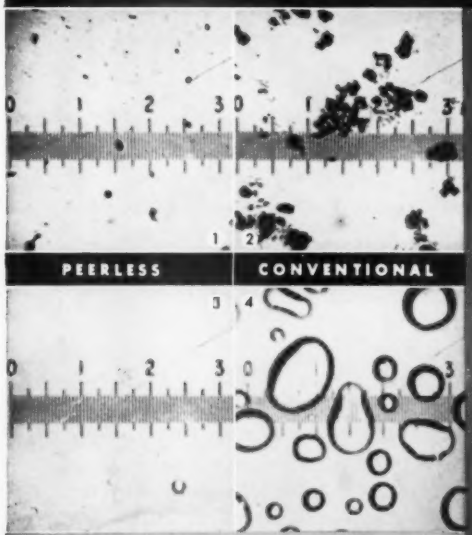


(A) The majority of incoming liquid and solid particles are directed down into reservoir. 1

(B) Lighter solid particles carried by gas stream are separated on surfaces of contactor which are kept wet and clean by revolving through liquid reservoir. 2

(C) Contactor is revolved by explosion-proof gear motor.

(D) Mist Extractor removes any remaining liquid particles from gas stream prior to outlet. 3



These photographs were made of microscope slides introduced downstream of the Scrubosphere and a conventional vertical oil bath cleaner under the same operating conditions. Plates 1 and 2 show the comparative amounts of iron oxide not removed with the amounts introduced being identical. Plates 3 and 4 indicate comparative oil loss with vapor rate through the vessels being the same.

LOOK AT THIS TEST The test at the left indicates the superiority of Peerless Scrubosphere over conventional oil bath dust scrubbers. The SCRUBOSPHERE operates with no loss of efficiency at low flows, minimum liquid loss, and very low pressure drop. Other outstanding features include easy vessel access with removable self-cleaning contactor, a sump for slugs of solid or liquid particles, and minimum cost.

For detailed information write for Bulletin No. 181

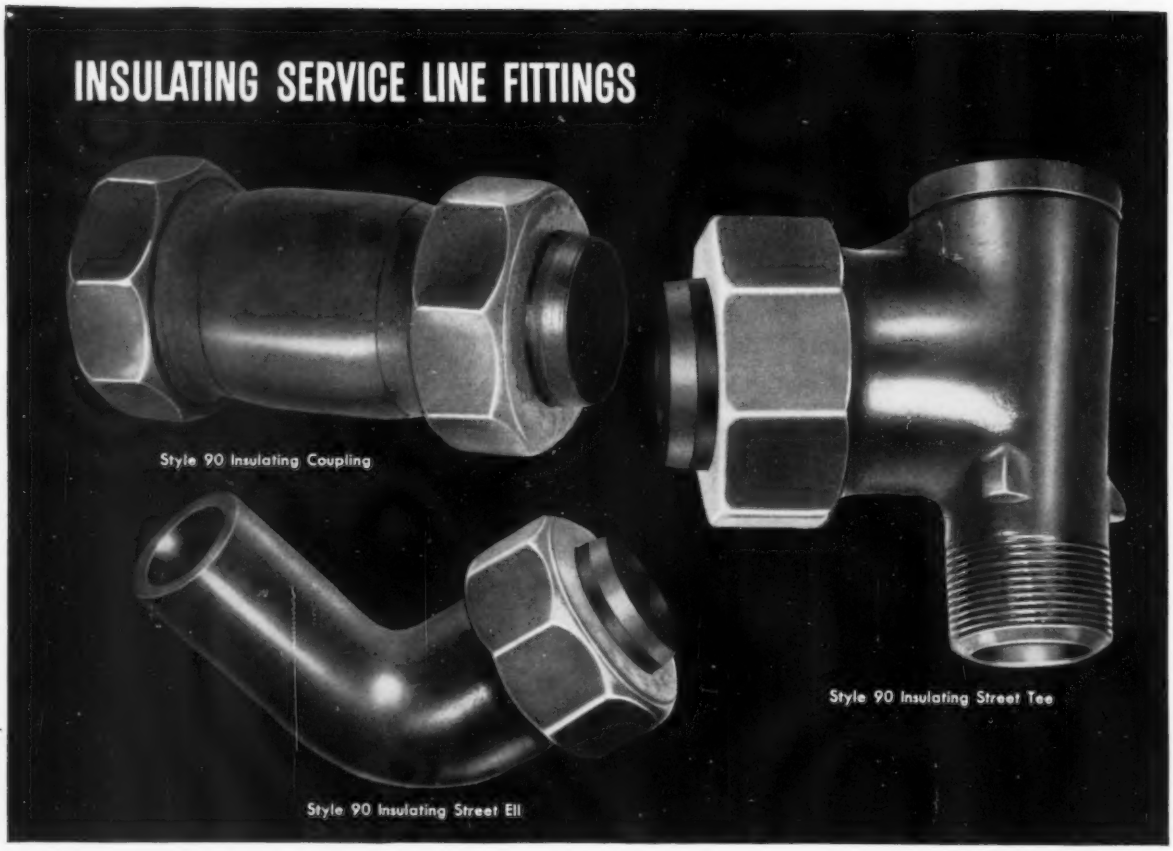
PEERLESS MANUFACTURING CO.

P.O. Box 13165 Dallas, Texas

Representatives in All Principal Cities

PEERLESS MFG. CO. DALLAS TEXAS

INSULATING SERVICE LINE FITTINGS



Fight corrosion at the service line with Dresser Insulating Fittings!

Gas utility men agree that the service line, being nearest to the consumer, deserves the best protection from these two major causes of corrosion: stray d-c currents and dissimilar metals.

Then, too, consumer services are often transmitters of harmful currents. Their insulation is a logical protective step.

For protection of service lines, there's nothing as efficient or as economical as Dresser Insulating Couplings and Fittings. They combine two jobs: (1) join service pipe quickly and permanently (just stab plain-end pipe into couplings and tighten nuts); and (2) serve as an insulating joint.

Both the nut and the coupling body are insulated from the pipe. The Nylon Insulator extends over the pipe end and effectively stops the flow of current from one pipe to the other. Nylon is tough, inert, resistant to attack by oils in gases and is not susceptible to swelling, flow or other impairments.

Write today for catalog describing *Dresser Corrosion Control Products.*

This new Dresser green Nylon Insulator will be supplied in all standard insulating couplings and fittings. Gives all-round improved efficiency.

DRESSER® CORROSION CONTROL PRODUCTS

Dresser Manufacturing Division, 69 Fisher Ave., Bradford, Pa. Warehouses: 1121 Rothwell St., Houston; 101 S. Airport Blvd., S. San Francisco. Sales Offices also in New York, Philadelphia, Chicago, Toronto.

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HOW TO LOWER THE PRICE TAG ON UTILITIES ACCOUNTING

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With IBM punched card methods, your accounting system not only expands with increased accounting volume . . . but easily handles *all* Utility Accounting jobs!

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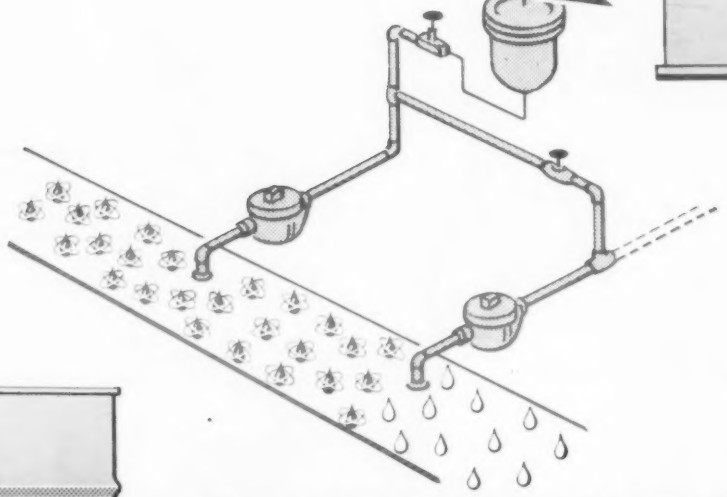
CAPTAN concentrated odorants—

- contain one hundred per cent **useful odorant** materials
- penetrate further
- are tailored to YOUR needs by our field odorization specialists
- cost less per million cubic feet of gas odorized



NATURAL GAS ODORIZING, INC.

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There's peace of mind in this

SAFE INSTALLATION

When you fabricate your large volume meter sets with Rockwell products, you can be sure of this—your measurement will be accurate, your regulation constant, your valves will turn easily and shut tight.

And there's extra security built right into all Rockwell products—to resist shock, to prevent leaks, to discourage tampering.

Next time, why don't you go all the way with Rockwell? Enjoy the peace of mind that comes from using only the finest, safest equipment.

ROCKWELL MANUFACTURING COMPANY

PITTSBURGH 8, PA. Atlanta Boston Charlotte Chicago Dallas Denver Houston Los Angeles Midland, Tex. New Orleans New York N. Kansas City Philadelphia Pittsburgh San Francisco Seattle Shreveport Tulsa In Canada: Rockwell Manufacturing Company of Canada, Ltd., Toronto, Ontario

ROCKWELL METERS, REGULATORS
ROCKWELL-Nordstrom VALVES

WHEN you think of "service" in relation to equipment, two meanings for the word come to mind. The first relates to how well the equipment performs. The second, how well the supplier handles the details of getting equipment, parts or information into your hands.

Rockwell has built its business by

SERVICE

...that helps customers is our primary aim

giving a superior degree of service of both types. In Rockwell products we have combined the best talents of design, engineering and manufacture to merit your long time satisfaction. To better serve you with the equipment you need, we have established a coast to coast network of plants, warehouses and sales offices, interconnected by the latest type of communication and order handling systems.

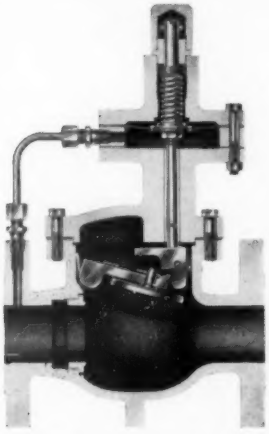
This means you can contact any Rockwell office or Rockwell salesman for prompt shipment of products or parts, often from warehouse stocks.

We at Rockwell are proud of a fine record of service . . . and a growing list of satisfied customers. Manufacturing only top quality measurement and control equipment is our first interest . . . but conducting our business to please you, our customers, is the primary aim. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

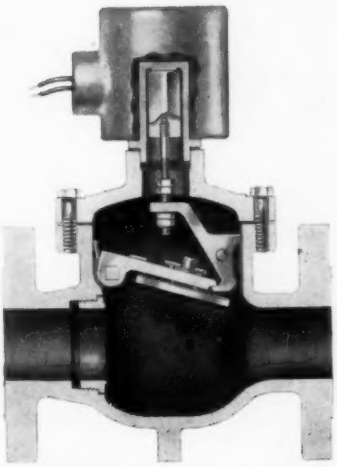
FOUR WAYS IN WHICH ROCKWELL EXCELS

RESEARCH • SAFETY • ACCURACY • SERVICE

ROCKWELL GAS METERS AND REGULATORS

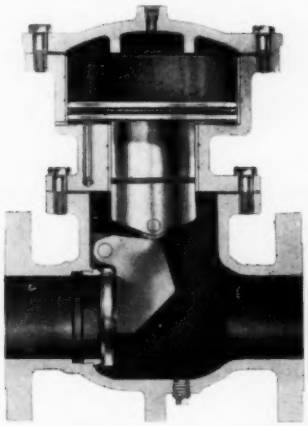


Model 1500H shown, is a high pressure shut-off valve which closes automatically and instantly when predetermined high pressure is reached. With addition of a fusible metal plug, valve can be furnished to shut off on overpressure and/or over-temperature. With control pressure above diaphragm, valve can be made into a low pressure shut-off valve. Combination high and low pressure shut-off also available.



Model 1700 shown, is a Solenoid operated valve normally energized to maintain valve in open position. On interruption of electric current valve closes instantly. Model 1800 Solenoid shut-off valve available to shut off gas instantly by applying electric current either automatically or through a "panic" button.

Instant action, sure and safe with Coppus Sentry® Valves



Model 3000 shown, is a piston operated valve, which opens instantly when pressure above the piston is released. Restoring the pressure above the piston closes the valve. The operating pressure above the piston can be obtained from the line or from an independent source of gas or liquid and can be automatically released or applied by instrument air or gas operated pilots or by use of a small three-way Solenoid valve.

Sentry Valves assure better protection of personnel and property. Instant, split second action with full flow, available in two basic types. Sentry Latch type valves for instant automatic closing; Sentry Piston type valves for automatic opening and closing.

The Latch type requires manual reset — the piston type can be opened and closed automatically.

Sentry Valves can be actuated by high or low pressures, by excessive temperatures, by excessive flow or electrically by use of a Solenoid.

Standard sizes — all Full-Flow — in steel or meehanite 1½" to 8".

To get more detailed information on this outstanding line of Coppus Sentry Valves send the coupon.

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Get time-proved pipe facts– Make your own comparison

After careful comparison, the facts will show that American Cast Iron Pipe excels for gas service. In large or small diameters, this rugged, high-strength material provides the longer life that means greater over-the-years economy . . . lower annual cost.

Manufactured with the original standardized mechanical joint designed specifically for gas service, American Double-X Cast Iron Pipe, since its introduction, has been the first choice of engineers and officials for hundreds of gas transmission and distribution installations.

Compare the economy and dependability of American Cast Iron Pipe with that of any other pipe. Call the American Cast Iron Pipe Company representative near you to get time-proved facts for your comparison.

Installation of large diameter American Double-X Cast Iron Pipe at a Midwestern gas utility.

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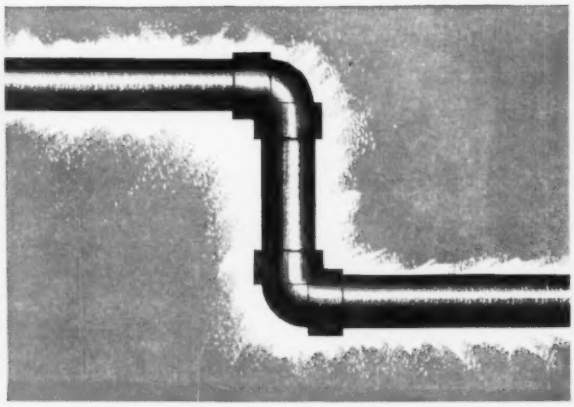
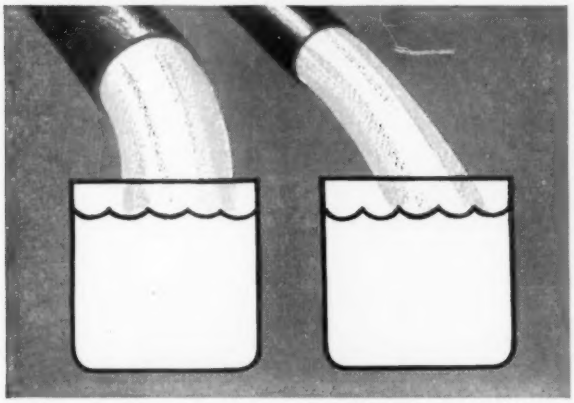
News about

B.F.Goodrich Chemical *raw materials*

1. lower first cost . . . *Piping made from rigid Geon polyvinyl raw materials generally costs less than standard steel pipe wrapped for corrosion protection. Savings with comparable sizes range up to 25%.*



2. corrosion resistant . . . *Geon vinyl is unaffected by chemical corrosion from soil conditions. Likewise it is immune to galvanic action —the major source of high-cost pipeline trouble.*



3. greater fluid delivery . . . *A Geon pipe 20% smaller in diameter than steel pipe gives the same fluid delivery because of lower frictional loss.*

4. faster installation . . . *Besides being light, Geon pipe is easy to handle, cut and join. Two men can lay a mile of three-inch Geon pipeline in eight hours. A similar lay with metal pipe would take 24 to 30 hours; cement-lined pipe some 80 hours.*

4 ways you save with Geon vinyl pipe

IN performance, too, you save with Geon vinyl pipe. It has high impact and tensile strength, is exceptionally resistant to oil, acids, alkalis and most chemicals. Its smooth internal surface reduces flow resistance, inhibits build-up of deposits.

Get information on rigid Geon polyvinyl compounds 8700A and 8750 for rigid plastic pipe. Write Dept. FO-6, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B.F.Goodrich Chemical Company
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B.F.Goodrich GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors

The new Superior ALUMINUM CASE METERS

. . . the slow-motion meters you can rely on longer

This slow-motion, long-lived meter operates at only 7 revolutions per cubic foot to reduce wear and stay accurate longer. And its simple, horizontal seam construction gives fewer chances for leaks . . . makes maintenance quick and simple. Whether it's adjusting the tangent through the handy access in the top . . . removing the top to grind the valve seat . . . or lifting out the valve table with the entire inner movement to replace the diaphragm, simply loosening a few screws makes everything accessible.

Get full details. Send for bulletin 1150.

This modern meter exploits all the time-tested advances in meter technology *plus* the latest manufacturing techniques of Superior's new plant.

SUPERIOR METER COMPANY, INC.
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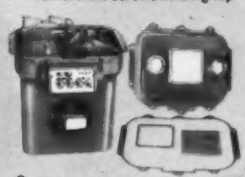
A SUBSIDIARY OF NEPTUNE METER COMPANY

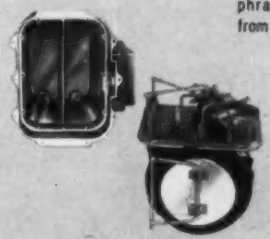
neptune

Look at these advanced design features:

1. Simple, horizontal seam . . . eliminates leakage . . . easier maintenance
2. Easily accessible table . . . just remove the screws holding top

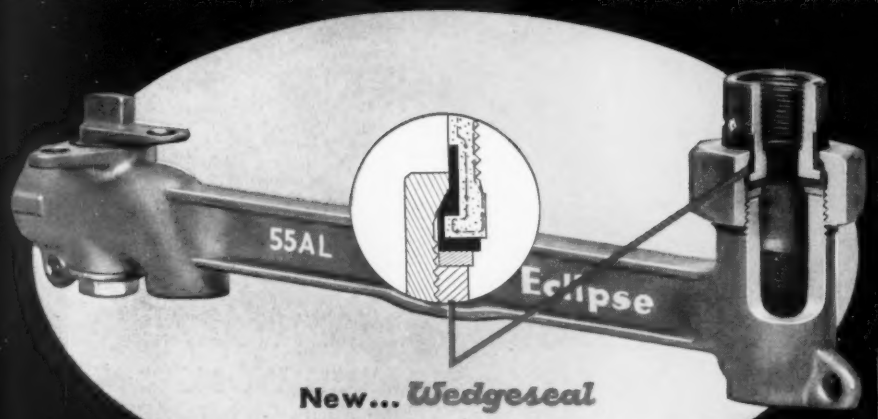


3. Meter top removable without taking off index box
4. Valve seat readily accessible for grinding when top is removed
5. Slow movement; only 7 revolutions per cubic foot
6. Seam gasket stays resilient . . . cork and Buna-N composition
7. Valve table lifts out with entire mechanism



8. Heavy-duty, sintered bronze bearings oil-impregnated for life
9. Flag arrangement gives arm smoother operation and longer life
10. Accurately controlled diaphragm . . . no inaccuracies from deflection
11. Cupped handling lids permit easy and safe carrying
12. Handy access for tangent adjustment and calibration
13. Broad base for solid stacking . . . designed for conveyorized handling
14. Index removable without removing meter

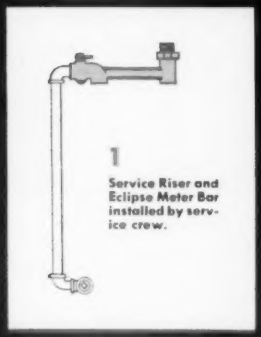
In 250 cfh and 340 cfh sizes to meet most domestic requirements.



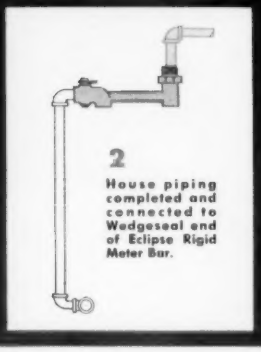
New... *Wedgeseal* insulated unions

Here's how you can set meters for life...with

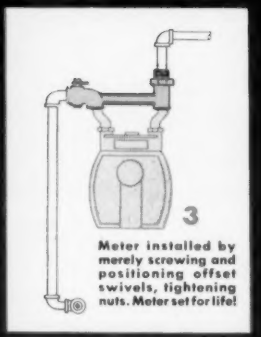
ECLIPSE RIGID METER BARS



1 Service Riser and Eclipse Meter Bar installed by service crew.



2 House piping completed and connected to Wedgeseal end of Eclipse Rigid Meter Bar.



3 Meter installed by merely screwing and positioning offset swivels, tightening nuts. Meter set for life!

You can simplify and standardize the installation of tin, iron, or aluminum case meters for life by using Eclipse Rigid Meter Bars with Wedgeseal insulated unions. These new, one-unit meter bars give you a "focal point" from which, and to which, to work. They reduce the number of fittings and eliminate "bridging the gap" (left by service crew or plumber) in meter hookups. Piping alterations are eliminated on periodic meter changes. Eclipse *Wedgeseal-Insulated* Rigid Meter Bars offer the simplest and most economical way to install meters, to insulate mains and services from stray or induced house currents.

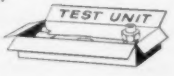
NEW WEDGESEAL UNION OFFERS COMPLETE, PERMANENT INSULATION—Integral Zytel 105 union insulator has exclusive "wedge" design — prevents jumping — eliminates shearing action between nut and tailpiece. There is no assembly — no chance of the insulator being left out — no metal-to-metal contact — no shorting. Withstands 350 ft lb applied torque — takes all strains imposed by house and service piping — is not affected by manufactured, natural, or LP gas. Eclipse Rigid Meter Bars with Wedgeseal Insulated Unions are available with or without integral gas cocks. Use the coupon below to obtain your free test unit.

WEDGESEAL UNIONS AVAILABLE for many insulating applications — ⅜, ¾, 1, and 1¼ in. sizes now in production, with larger sizes to follow.

Eclipse®

GAS COCKS and METER BARS

Send for free WEDGESEAL meter bar — see Bulletin P-1 for style number and connection sizes desired.



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1109 Buchanan Street, Rockford, Ill.
Eclipse Fuel Engineering Co. of Canada, Ltd.
20 Upjohn Road, Don Mills, Toronto, Ontario

Please send No. ....., ...x.....x..... for ( ) tin, ( ) aluminum, or iron case meters to:

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JAEGER'S 50 CFM MORE AIR SPEEDS RUSH WORK

By producing 365, not 315, cfm of 100 lb. air, this Jaeger Rotary is operating six 80 lb. breakers at full efficiency to finish a rush job in busy Benjamin Franklin Parkway, Philadelphia. Full load speed only 1700 rpm.

FULL AIR PRESSURE AT 5200′ ELEVATION

Installing cable for Denver, Colorado utility, this Jaeger "125" Rotary is holding full pressure in two Thor heavy duty breakers. Full load speed is only 1700 rpm. Jaeger originated the 125 cfm compressor rating.

JAEGER'S 125 AND 250 CFM SIZES ON 2-WHEELS

Jaeger 125 and 250 rotaries give you the advantages of Jaeger's higher efficiency (1700 rpm full load speed instead of 1800-1950), plus full size tool boxes, retractable pneumatic-tired dolly wheel and 8-hour fuel tanks, with 2-wheel mounting. Four-wheel units are available in 365 and 600 cfm sizes.

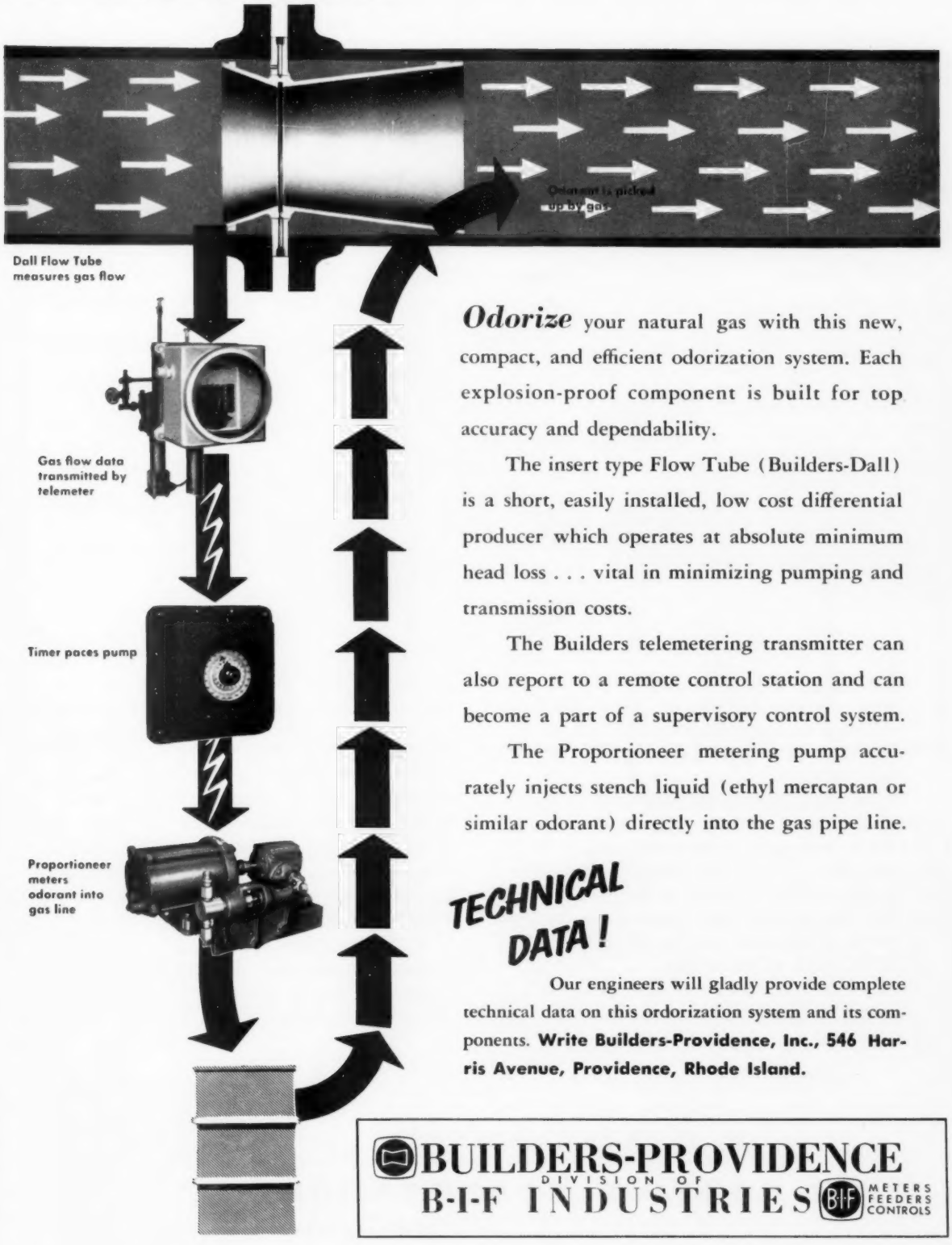
Your Jaeger distributor will gladly give you full details and demonstration — or let us send you Catalog JCR-5.

THE JAEGER MACHINE COMPANY

661 Dublin Avenue, Columbus 16, Ohio

Jaeger Machine Co. of Canada, Ltd., St. Thomas, Ontario

Odorize MORE ECONOMICALLY!!


Odorant is picked up by gas
Dall Flow Tube measures gas flow
Gas flow data transmitted by telemeter
Timer paces pump
Proportioneer meters odorant into gas line

Odorize your natural gas with this new, compact, and efficient odorization system. Each explosion-proof component is built for top accuracy and dependability.

The insert type Flow Tube (Builders-Dall) is a short, easily installed, low cost differential producer which operates at absolute minimum head loss . . . vital in minimizing pumping and transmission costs.

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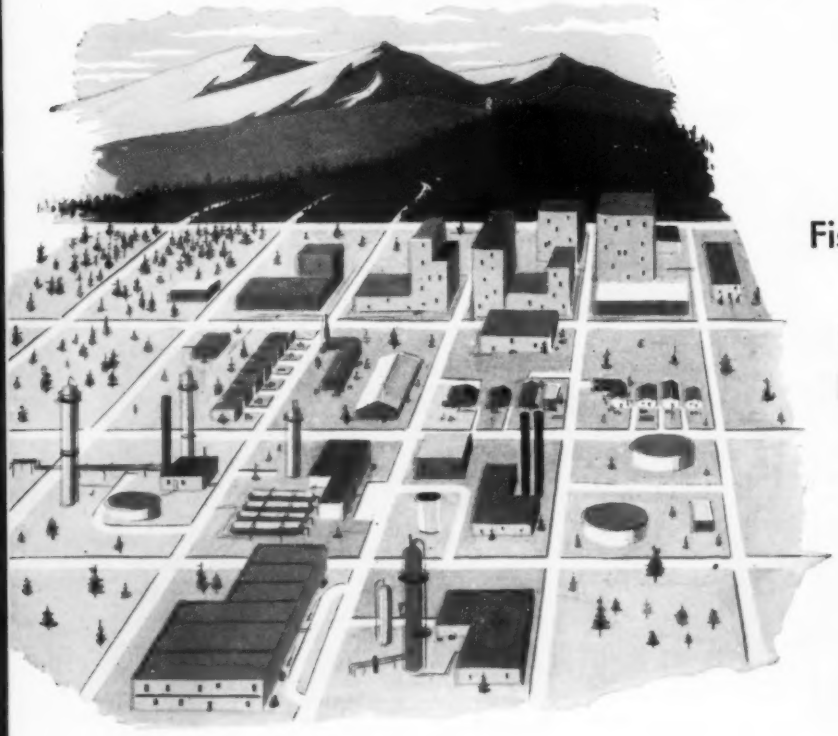
how Fish Service Corporation helped bring a new age of energy to SPOKANE



From initial Survey to final completion Fish Service Corporation supervised all steps in converting Spokane Natural Gas Company from an obsolete Propane-air utility to a modern, efficient natural gas distributing system.

IN EARLY 1953 Spokane Gas and Fuel Company saw little hope for the future. Sales were declining, the system was obsolete, cash was low, and prospects were so dim new financing was hard to get.

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The management then turned to experts. Fish Service Corporation was retained to take charge of all phases of the change.

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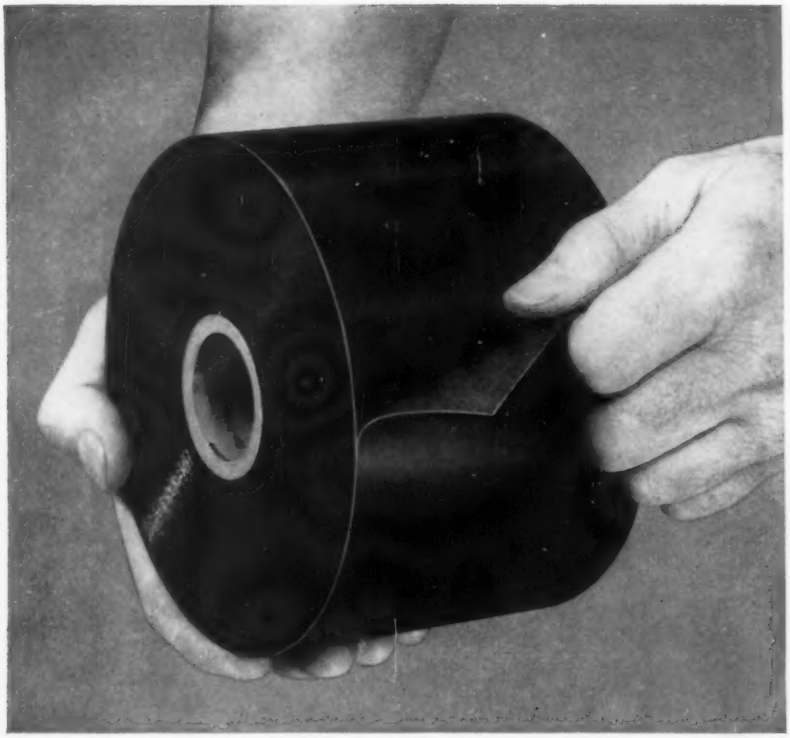

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GAS
NOVEMBER 1957

Odorization techniques in New York City

By R. L. CORYELL, Division Engineer
Consolidated Edison Co. of New York, Inc.

ODORIZATION of gas in New York City was initiated in 1951. During the following years, experience was gained with several types of odorizers and a number of odorants under a wide range of distribution conditions. In 1956, Con Edison completed the conversion to natural gas and the odorization practices were then greatly simplified.

All public utilities in New York State are required to odorize gas according to the following Public Service Commission Order.

"All gas distributed and transmitted shall be adequately odorized so as to render it *readily detectable* by the public and employees of gas corporations, the equipment to be used in such odorization to be sufficient to insure reasonably uniform odorization under varying conditions, such equipment to be installed in such a manner as not to be a nuisance to nearby residents by the escaping of odorant fumes. An appropriate record of the odorization practices shall be maintained and daily inspection of the odorization equipment shall be made, or, in the alternative, a sufficient number of tests shall be made to show whether the gas is adequately odorized throughout the

GAS exclusive

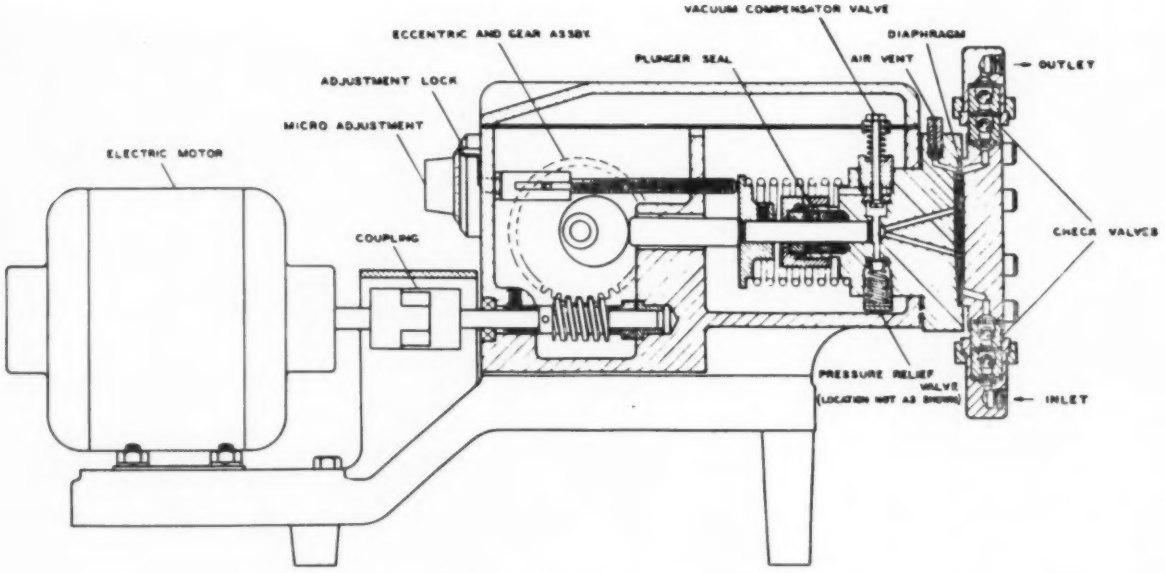

Fig. 1. Sectional view of piston-diaphragm type odorizing pump.

distribution system. Every gas corporation shall keep the commission informed of the type of odorant used, the ratio of odorant to gas and the location of the odorization stations."

Con Edison purchases all of its natural gas containing some odorant added by the suppliers. The odor level of this gas is increased by the regular operation of two odorizers to insure conformity with this order. In addition, a number of supplemental odorizers are available for use whenever inspection or tests indicate a need for additional odor in the gas in a specific area.

This article describes the present gas odorizers used by Con Edison and the steps taken to avoid nuisance odors as directed by the commission.

Natural gas is normally supplied to the Con Edison territory in New York City through two regulating stations located, respectively, in the Hunts Point (Bronx) and Astoria (Queens) gas plants. A semi-automatic odorizer utilizing diaphragm pumps is installed in the Hunts Point plant and a late type (MPX) Peerless odorizer is installed in the Astoria plant.

The Hunts Point odorizer is located on the main supply line and includes two Lapp "Microflo Pulsafeeders," one pump being a standby. The "Microflo" is a low capacity combination piston-diaphragm pump, as shown in *Fig. 1.* In this pump, a plunger reciprocates within a cylinder at an established stroke length, displacing an exact volume of oil, which acts only as a hydraulic medium. By means of this oil, the plunger hydraulically moves a diaphragm forward and backward. The displacement of this diaphragm travel, in turn takes in the odorant through the suction check valve on the suction stroke of the plunger and discharges a like amount of odorant through the discharge check valve on the forward stroke.

The odorizer installation is shown in *Figs. 2 and 3.* The pumps are fed from the calibrated day tank. A two-month supply of odorant is stored in the 200-gal underground tank. A gas pressure of 10 psig is maintained on both the supply tank and day tank. Such pressure is desirable to insure odorant feed to the pumps at all times. The transfer of odorant from drums to storage will be described later.

The regular pump is operated by a d-c motor with current from a variable transformer, housed in cabinet "B." A "Thy-Mo-Trol" unit controls this transformer in such a manner that the odorant pumping rate will be proportional to the gas flow. This rate may be taken from the differential pressure at an orifice meter or, in the case at Hunts Point, set manually in the control house some distance from the odorizer. Here the station attendant calculates the gas sendout hourly and sets the odorant control dial for the estimated sendout for the next hour. In this manner, it is possible to accurately odorize any sendout ranging from 0.5 to 7.0 MMcf/hr. Whenever it is necessary to shut down the regular pump for maintenance, the stand-by pump is operated and the odorization rates established by manually setting the micro dial at predetermined points. The daily odorant usage is determined by observing the 24-hr outage of the day tank.

These Microflo Pulsafeeders were provided with "Kel F" diaphragms, as this material appeared to be the most resistant to chemical and solvent actions of the odorants. After two years' operation, these diaphragms appear to be in perfect condition. The only maintenance has consisted of semi-annual replacement of the oil in the pump chamber. No odorant has been found in the old oil and no odors have been observed around the pumps.

The Astoria Plant gas odorizer is located on the main supply line. This odorizer includes a Peerless

MPX unit with 200-gal. supply and safety tanks, a revolution counter and a recording differential gauge, as shown in *Fig. 4*. A plug valve (NG 100) provides sufficient differential pressure to operate the odorant pump. This installation is similar to the ones found effective and dependable by G. G. Dormer[1] and which have been amply described in the literature.

Since this odorizer is located a short distance from a built-up residential area, it has been necessary to take extra precautions to avoid the release of nuisance odors. The following steps were taken to prevent such difficulties:

1. Hydrostatic check of the installed odorizer at 500 psig. Rewelding of several joints was found necessary to insure an absolutely leak-free unit.

2. Unit was operated with kerosene rather than odorant for one week to insure satisfactory operation of all moving parts.

3. Connection from odorizer vent to nearby water sealed holder to provide for "blowing down" the odorizer tank before each filling operation.

4. Peerless "drum unloader" provided with available 10-psig gas pressure to transfer odorant into supply tank.

5. Upon completion of unloading of a drum, 10-psig gas was passed through the "empty" drum and thence to the holder until last traces of odorant were removed. This should not require more than two days.

6. The "dry" drum was treated with 1 gal. of 5 per cent hypochlorite solution and filled with water. Finally, the top was cut out of the drum so it would not be used again commercially.

7. Provisions made to control nuisance odors as described later.

In a heavily populated area, such as New York City, the control of nuisance odors during gas odorization is most important. The escape of even a spoonful of odorant into the atmosphere not only contributes to poor public relations but may cause many leak complaint calls, which must be responded to. Utmost precautions are always taken to prevent such situations but a few "accidents" will occur.

Preventive measures have included use of all welded connections, installation of diaphragm pumps (previously described), venting of odorant tanks into gas holders or through activated charcoal, use of closed odorant transfer lines, providing check valves on gauge glass connections and adequate drum disposal measures. The odorant storage tanks are designed to hold enough odorant for several months' operation thus reducing the frequency of filling the tanks to about six times a year and minimizing possible nuisance odors.

Even after taking all known precautions, the nuisance odors

1. "Practical Problems of Odorization," G. G. Dormer, Proc. of AGA, 1954.

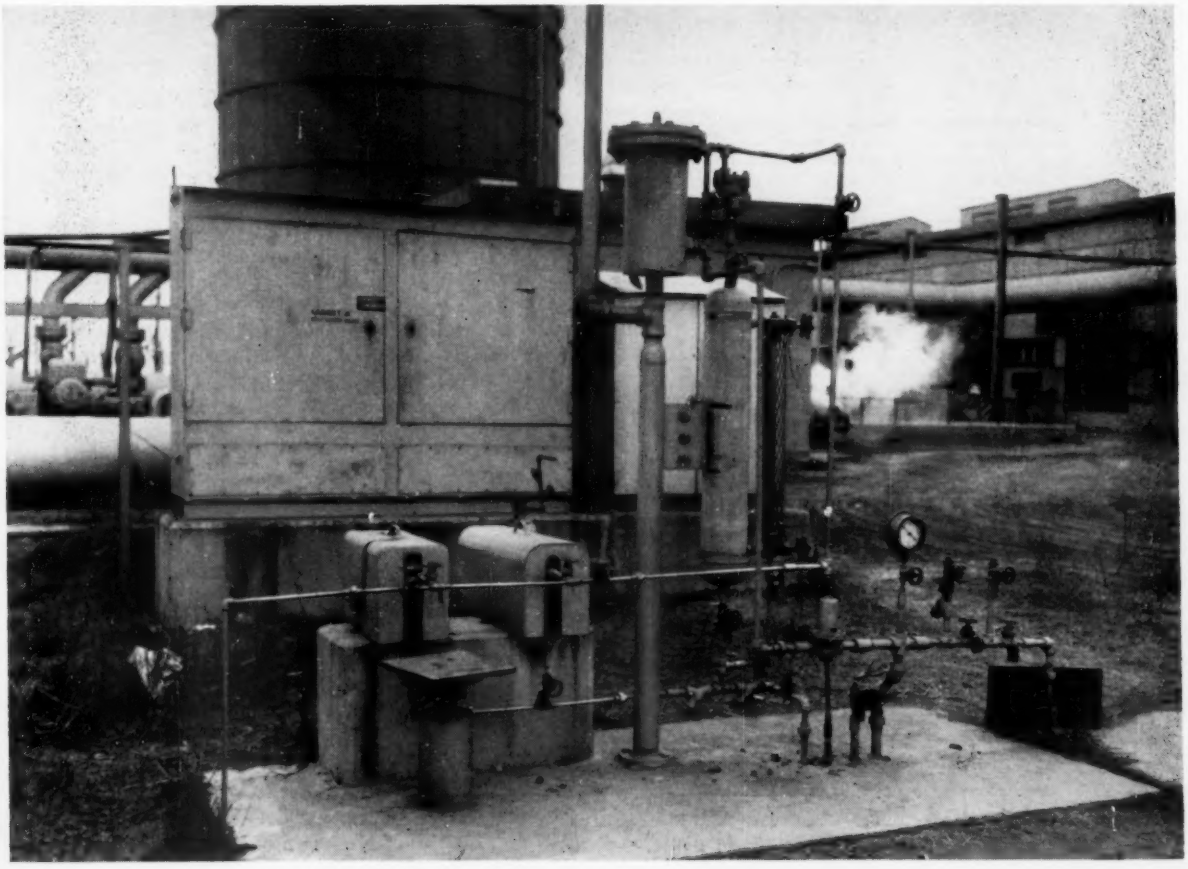

Fig. 2. Odorizer installation at Hunts Point plant. Controls are housed in cabinet in background.

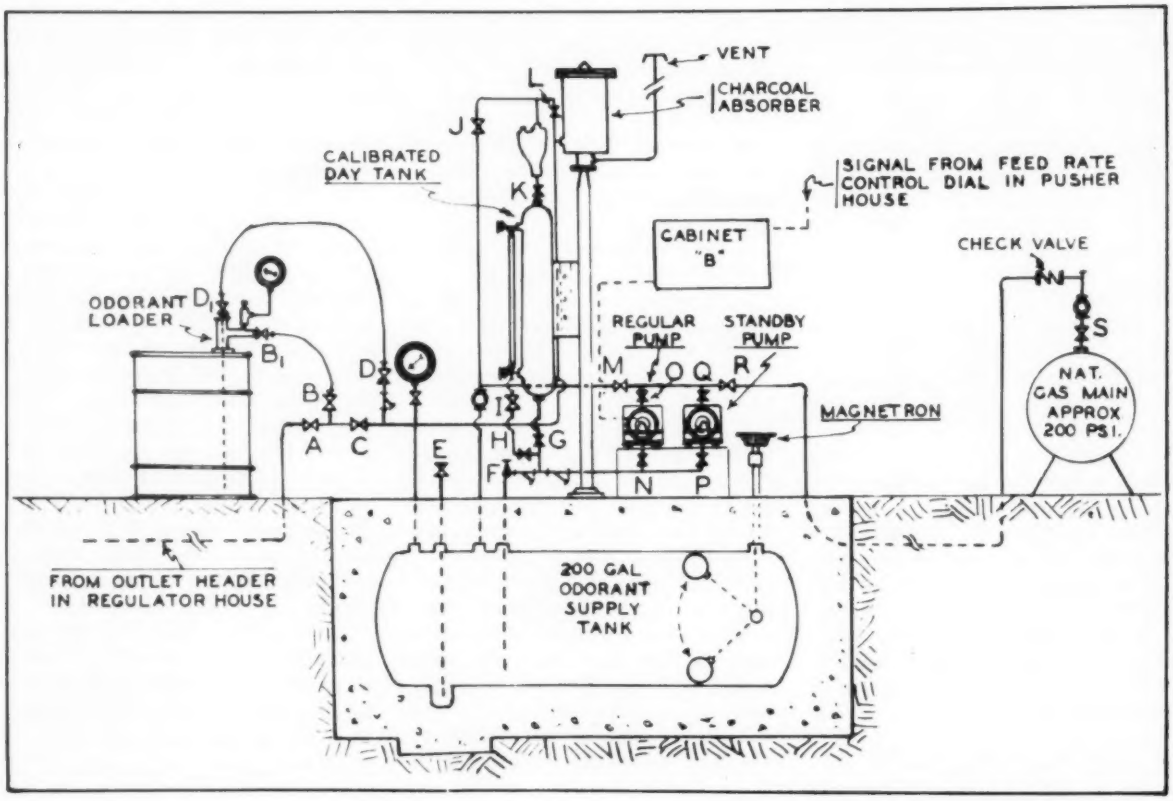

Fig. 3. Odorizer installation at Hunts Point plant.

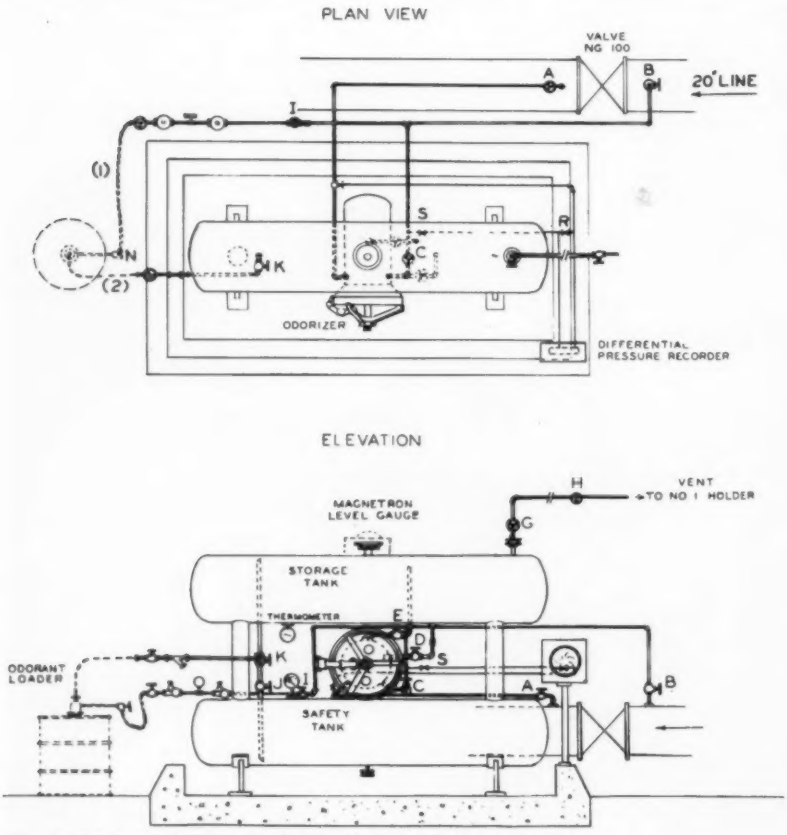

Fig. 4. Odorizer installation at Astoria plant regulating station.

are occasionally released during:

1. Opening and disposal of odorant drums.
2. Cleaning of filters on odorant lines.
3. Repair or maintenance of odorizer pumps.
4. Operation and use of supplemental odorizers.

Precautions for immediate control of possible nuisance odors are taken whenever work is to be done on an odorizer or odorant supply tanks are to be filled or vented. For this purpose, a gallon bottle of hypochlorite solution and an odor control fogger are always made accessible a few feet from the operations.

For treatment of odorant spills, it has been found that the copious application of dilute solutions of sodium hypochlorite generally eliminates the odor but the action is quite slow with the more concentrated odorants used in these odorizers. Spreading of finely divided activated charcoal, bleaching powder and other oxidizing agents on odorant spills have been

effective but have been discouraged due to the possibility of spontaneous combustion taking place at a later date.

To eliminate the nuisance odors in the air during odorant handling, the fogging of suitable chemicals has been found very beneficial. Experiments showed that a 1 per cent solution of masking agent such as "Wintair" (Polak and Schwarz) or "Neutroleum" (Fritsche Bros.) in kerosene practically eliminated the malodor when fogged into the atmosphere at the point where odorant was spilled. However, application of the solution to the odorant spill did not permanently neutralize the malodor.

A suitable fogging apparatus was made by connecting an oil fogging nozzle to a 15-lb carbon dioxide cylinder, as shown in *Fig. 5*. To provide for filling and pressurizing the cylinder, a 0.25-in. connection was made, as shown in the figure, and welded. About 1 gal. of deodorizing solution is charged into the cylinder, which is then pressurized to 100 psig with nitrogen. By opening the top valves (two are provided in series to prevent leakage), a fog is produced. One charge will last about 30 minutes or long enough for the hypochlorite to neutralize the spilled odorant.

The greatest care must be taken during the periodic filling (loading) of the odorant supply tanks on odorizers to prevent the release of nuisance odors into the atmosphere. In the first place the empty space in each odorizer tank contains gas saturated with odorant which must not be released directly into the atmosphere. In the second place disconnecting the odorant filling line from the emptied odorant drum provides an opportunity for odorant spillage. Obviously such filling operations must always be performed under adequate supervision.

Depressurizing the odorant supply tank may be effected by passing the vent gas through activated charcoal. This is done at Hunts Point where less than 10-psig pressure must be taken care of. At remote locations this saturated vent gas is burned off in flare burners, thus greatly reducing the nuisance odors. At the Astoria plant the odorant supply tank is depressurized from over 200 psig by venting directly into a 15-MMcf capacity holder where the saturated odorizer gas cannot over-odorize the sendout gas.

Opening of the odorant drums must be done cautiously, particularly during warm weather. Drums that appear quite warm after sitting in the sun should be well cooled before opening. Connect the odorant loading lines to the supply tank and source of gas pressure before inserting the loader into the drum, as shown in *Fig. 3*. After unloading, disconnect all lines and drain odorant back into the empty drum before removing the loader. Carefully place the loader into reservoir containing hypochlorite solution and gas out the drum as described above.

Thus it may be seen that the utmost precautions are taken in designing and locating the gas odorizing equipment in New York City. While all known nuisance odor preventative measures have been taken, there still is an occasional emergency to be coped with. The emergency deodorizing liquids are available at every odorizer location and the prompt use of these liquids generally eliminates the complaints, not only from the public but from company employees in the area. Supervision of all odorizing activities cannot take a holiday. There must be a constant check of not only the odorization operations but the means available to prevent the related nuisance odors. ■

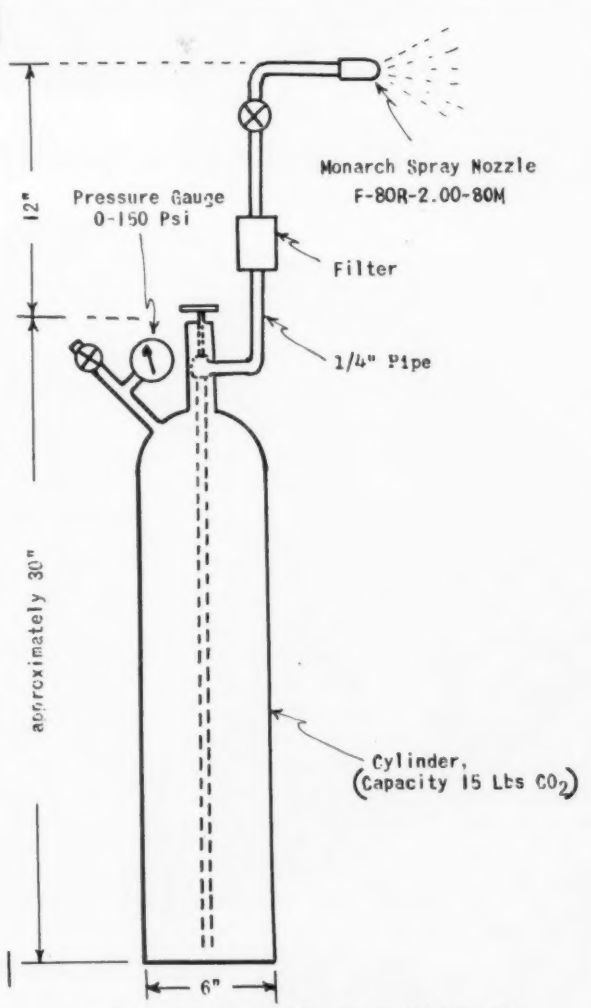

Fig. 5. Apparatus for fogging odor control chemical.

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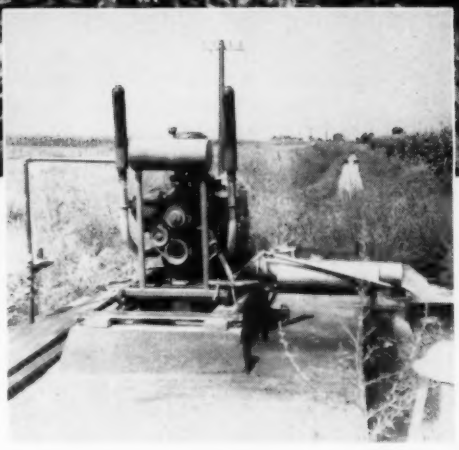

Kansas-Nebraska Natural Gas Co. provides fuel to pump irrigation water from more than 3500 wells in the drouth-stricken midwest. Low cost of the gas has made it economically feasible to irrigate land that formerly went dry.

Farmers turn to natural gas for irrigation pump fuel

By PETE BOUGHN, Omaha, Neb.

KANSAS-NEBRASKA Natural Gas Co., with the nation's first system of rural pipelines, is powering an agricultural revolution in the rich, flat farmlands of central Nebraska, western Kansas and eastern Colorado.

Since 1954, the project has grown from a small band of farmers who were "willing to toss the dice and see what came up" to a network serving 350,000 acres with 875 miles of high pressure lines and 600 miles of service lines direct to the irrigation pumps in the corn and grain fields. The 875 miles of high pressure lines feasibly expose a total of 1.1 million acres to natural gas service.

"It's the greatest thing that's happened to Nebraska farming since the railroads," a small-town implement dealer and extensive land owner stated.

Farmers are virtually stampeding to irrigation because of the low fuel cost offered by natural gas. Art Sigel, agricultural representative for Kansas-Nebraska, recalled the old days when farmers responded to his selling attempts with silent, unbelieving expressions. Today, whenever weather keeps the farmers from their fields, as many as a hundred are likely to crowd into his office, clamoring to be included in one of the irrigation projects.

Kansas - Nebraska's agricultural division has almost outgrown its facilities, and can look forward only to more growth in the years ahead. And, equally important, the summer load "valley" is filling in.

It's simple as elementary arithmetic. Statistics based on a survey made by two engineers with the University of Nebraska Extension Service show that natural gas costs one-fourth or less of any other fuel or energy used to power irrigation pump engines. For example, it costs a farmer $2.86 per acre for two acre-feet of water to irrigate with gas. Electricity, doing the same job, costs $8.84.

The topsoil along the Platte and

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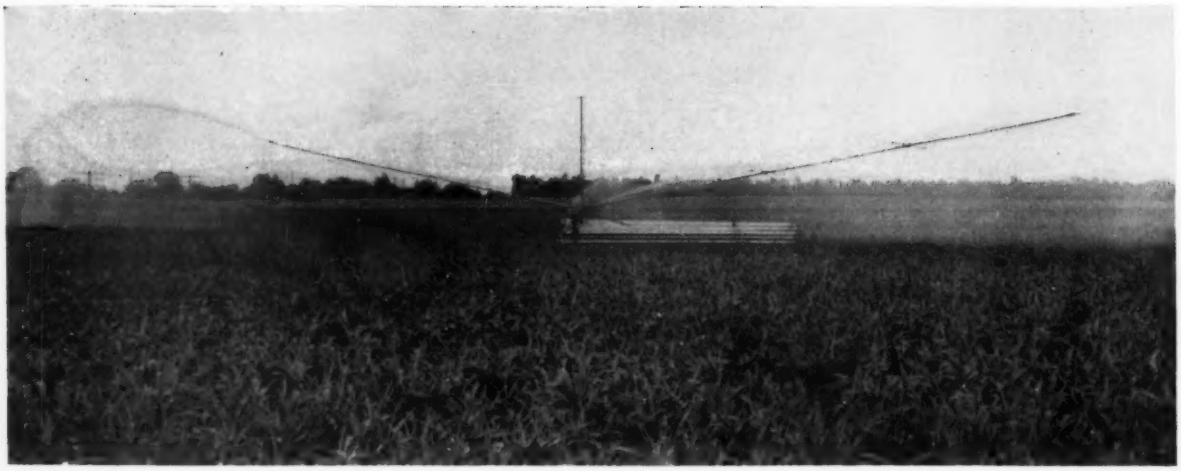


This machine irrigates several acres at one time, spewing water over crops as it rotates.

Republican rivers is deep and rich. Nebraska has the greatest underground water supply in the nation. The key to getting the two together is a well.

Farmers in the area, particularly those on land where deep wells with lifts of several hundred feet had to be dug, found it economically difficult to irrigate. Natural gas was available before 1954 only to those farmers fortunate enough to be located near main tranmission lines. Then Kansas-Nebraska came up with its project plan, various chambers of commerce supported the idea, and finally a few farm groups decided to take a chance.

Mr. Sigel was handed the job of selling the program. His company figured that if enough farmers in a given area were sold, a pipeline serving their needs would be feasible. And because of the summer dip in demand for natural gas, attractive rates could be offered to irrigators on an interruptible basis.

Mr. Sigel attended countless meetings, some lasting until the early hours of the morning. Farmers are not easily persuaded to try something new, and the plan almost died several times. But in March 1954, the first project went into operation. For another year Mr. Sigel continued to meet resistance —only 91.5 miles of pipe were laid during this time. Then the program caught fire. The project idea was selling itself by 1956—in an area plagued with extended drouth.

From Aug. 1, 1956, to Aug. 1, 1957, the company sold 1.75 billion cu ft of natural gas for pump irrigation fuel.

Farmers themselves organize their own projects. First they form a committee (which the company finds more practical to work with than a large group). The committee gathers such data as survey statistics, proposed locations for pumps and needed rights-of-way. Then the gas company, which originally determined the economic feasibility of the project, lays out a system and computes the cost. The completed plan is then presented at a general meeting of all the farmers in the proposed district.

Kansas-Nebraska builds and maintains the main distribution lines at a cost to the farmers of from $1200 to $1400 per well. Private companies, contracted for by the farmers, construct the service lines.

Any irrigator wanting to join the project after it is in operation pays a pro-rated share of the cost of the high pressure line. This share is refunded to original participants during the first five years.

The natural gas is sold to the irrigators at a present rate of 26 cents per Mcf. A farm customer also may use natural gas from the line for domestic purposes. He pays

This Buffalo county, Neb., farm is irrigated by water pumped by gas-fired pump. Well on the farm is 243 ft deep.

the regular retail zone rate for this service. Separate metering is done for such purposes as crop dryers, stock tank heaters, and home heating.

One farmer estimated that the cost of converting his irrigation well pump to natural gas was recovered in 18 months. He pumped a 204-ft well at 700 gpm in 1953, using another fuel, at a cost of $1100. With natural gas last year his cost totaled $248 — and he pumped more hours.

Kansas-Nebraska estimates that in its Hastings division alone, farmers saved a million dollars in fuel costs in one year by converting to natural gas—and that's a million more dollars to be spent in the neighboring communities.

While other gas companies, located in more densely populated areas, can look to heavy industry to take up the slack between winter and summer consumption, Kansas-Nebraska must depend almost entirely on agricultural uses in its region. The company now estimates that demand for natural gas by irrigators has increased summer usage from 50 per cent of winter consumption to 60 per cent.

As of Aug. 1, Kansas-Nebraska was serving about 3500 wells throughout its system. Of that total, 3050 are in Nebraska. That's about 15 per cent of all the irrigation wells in the state.

An important development recently has been the extension of domestic service into small towns which otherwise went without natural gas. Six communities in Nebraska — Hildreth, Wilcox, Upland, Phillips, Marquette and Henderson—now have natural gas because irrigation lines were laid nearby. Three more communities will join the Kansas-Nebraska system next year.

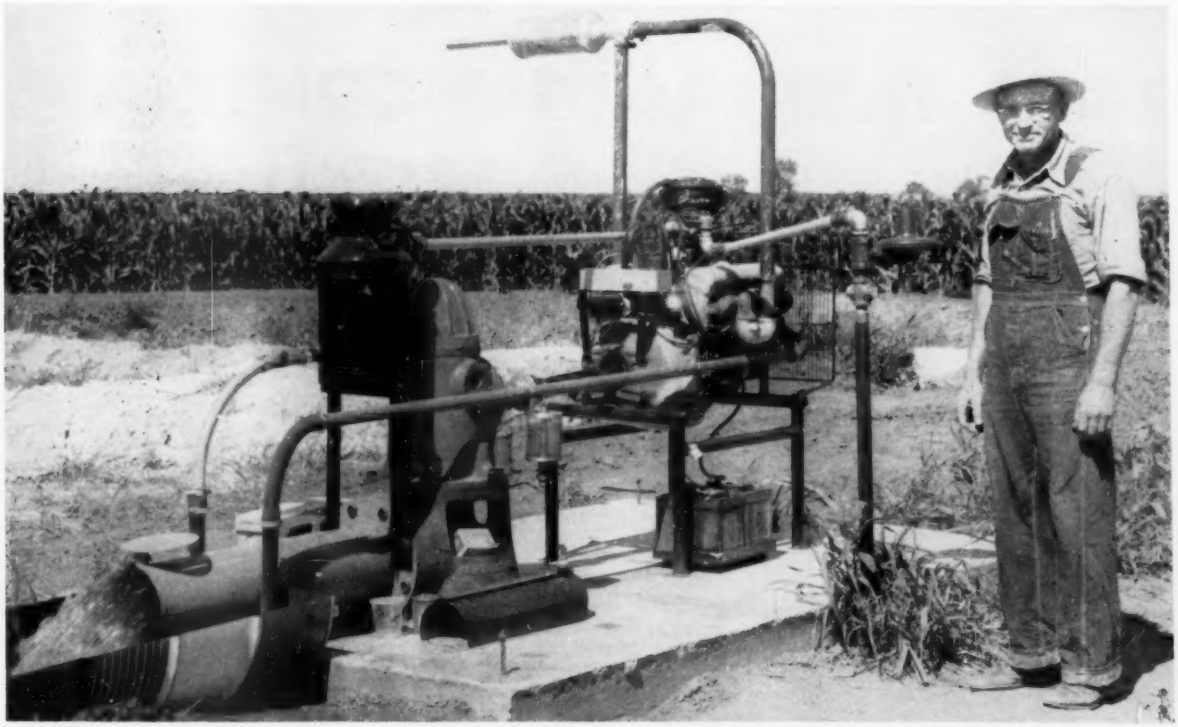
The stabilizing effect on the agricultural economy of the area is immeasurable. Irrigation is the great equalizer of drouth, in addition to producing 85-bushel corn as compared to 35-bushel corn raised on an acre of dryland farming. Because of the ready availability of water, crop diversification can be practiced. Already a national canning concern harvested a crop of 20 tons of tomatoes per acre on a test plot in the area. Diversification can be the answer to the farm surplus dilemma.

The economic effects of the rural pipeline system are felt throughout the river valleys. Banks, at first skeptical, now are more willing to make development loans where natural gas is available to the farmer. At least one banker makes his loans contingent on the farmer converting to natural gas.

The company this year amended its irrigation development plan. In areas where potential development is almost assured. Kansas-Nebraska will advance the cost for additional capacity in lines, with that costs to be recovered later from new participants. This avoids extensive enlargements in the main distribution lines within a short time. Such projects total 150.82 miles of pipeline at a cost of some $1,118,000.

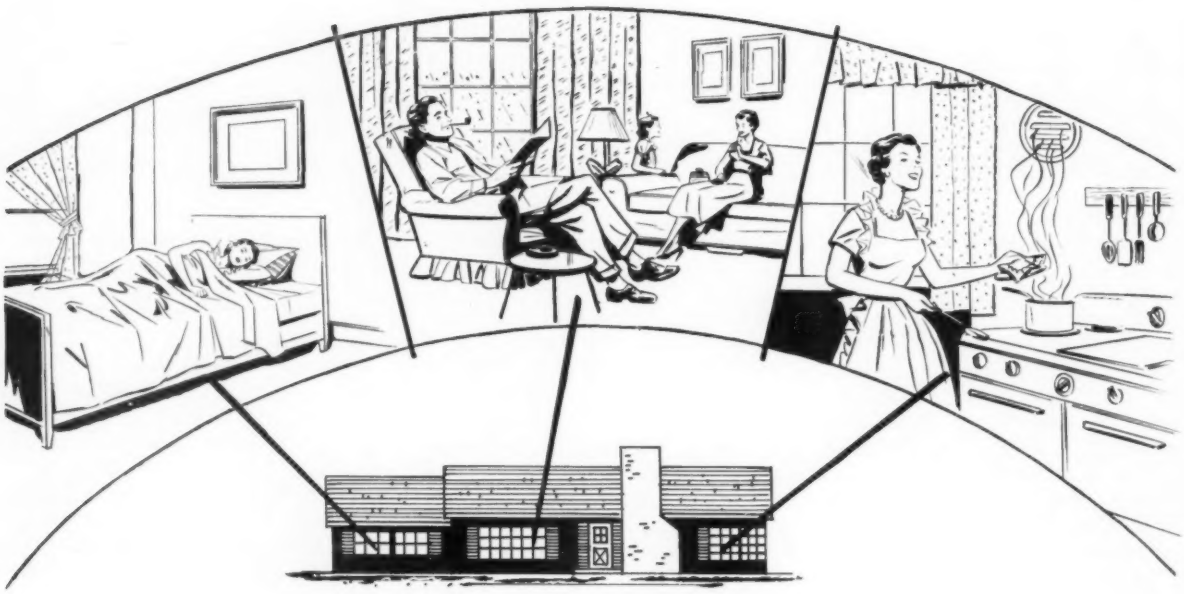
"Summer sales help pay for the maintenance and operation of our system, and in turn help us keep rates to winter users at lower levels," S. D. Whiteman, Kansas-Nebraska's president, noted.

"But far more important, we feel that anything that is good for the Great Plains is good for us, and certainly, sound irrigation practices can contribute immeasurably toward stabilizing our agricultural economy. When this region prospers, everyone in it prospers. It's as simple as that." ■



Henderson (Neb.) farmer John R. Doell stands by his third gas-fired irrigation pump.

PART 2



ZONE TEMPERATURE CONTROL

What the serviceman should know about it

By LLOYD H. JOHNSON
Minneapolis-Honeywell Regulator Co., Minneapolis

This is the second in a series of three articles on zone temperature control. The previous article told why zoning is becoming widely used in residential heating and air conditioning. It is the answer to numerous temperature control problems which have arisen as a result of features commonly found in the contemporary home. This installment covers the basic structure of zone control systems and discusses dampers, damper operators, valves, circulators, relays, and wiring panels specially designed for zone control applications.

• *How zoning is accomplished*

IN zoning, the control equipment at the heating or cooling plant remains essentially the same as it would be with the usual single thermostat type of installation. There are exceptions and variations, depending upon the type of system, and control features. From the standpoint of control, each zone system operates independently, ex-

cept that in most installations any one zone calling for heating or cooling can generally start the burner or compressor.

In a forced hot water system using zone valves and a single circulator, the circulator and burner (subject to limit protection) operate as long as any zone demands heat. Such inter-related switching operations are accomplished through relays and auxiliary switches. When a system includes three or more zones, a zone wiring panel is generally used. These panels enable the installer to standardize on the wiring, and to have wiring terminals centrally located in a neat, convenient cabinet. Such a terminal panel also simplifies the job of checking system performance. If central cooling is incorporated in the system, special heating-cooling control panels are available to correlate and sequence the switching. A manual changeover switch is normally used with domestic installations of central heating and cooling.

Where a Series 80 (two-wire, low-voltage) thermostat or electronic moduflow is used to control a zone valve of different circuitry (3 wire Series 20, for example) or a line-voltage circulator, an *intermediate relay* is used in the zone control system. By using this relay, greater freedom of selection in thermostatic control is possible. Without such a relay on a zone circulator system for instance, it would be necessary to employ a bulkier, less sensitive line-voltage thermostat.

The method of zoning will depend upon the character of the installation, the features desired, and the number of zones in the system. The following systems are referred to as "Zone Re-Balancing" systems because they do not interfere with continuous air circulation (C.A.C.).

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CENTRAL FORCED AIR SYSTEMS

• *One damper actuator, for 2-zone balancing system*

For heating and heating-cooling: This system uses a single damper actuator, with an interconnecting linkage to the two opposed action zone dampers. It is a minimum cost zone system which operates so that one of the zones (such as the recreational or sleeping area) can divert supply air to each zone as required.

On the heating cycle, the thermostat in the main zone controls the burner. The thermostat in the other zone controls the balancing dampers, but can also operate the burner under demand conditions. These opposed dampers equally portion heat, as long as zone requirements are equal. Should one area require more heat or less than the other, the dampers move gradually to supply more or less air to that zone. Under normal conditions these dampers will not completely open or close.

During the cooling cycle the thermostat in the other zone controls the compressor, and the main zone thermostat controls the dampers. Either a separate cooling thermostat or a combination heating-cooling thermostat is used in each zone. In a zone installation of this type where the finished basement comprises the second zone, for example, it is advantageous to control the cooling compressor from the thermostat in the main zone. The damper actuator (operating the two opposed zone dampers) would be controlled by the thermostat in the other zone.

• *Modulating air volume system—3 or more zones*

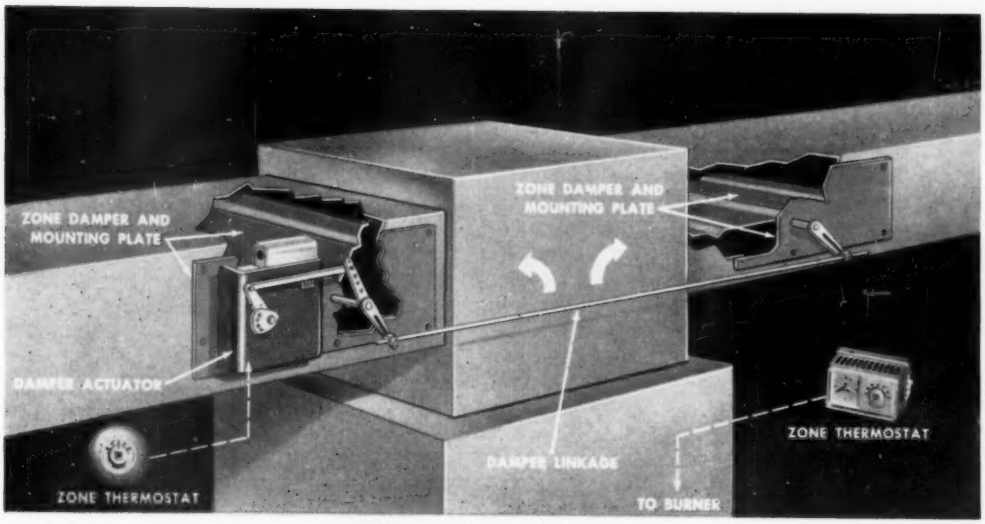
For Heating and Heating-Cooling: This system regulates the flow of heated or cooled air to each zone according to the demand of the zone thermostat. Each zone normally has its own supply and return system. Individual zone thermostats, operate a separate modulating damper actuator, which operates a damper in the zone supply. As the zone thermostat senses a need for more or less heating or cooling, it positions the modulating damper actuator which in turn positions the damper in a more or less open position. Therefore, the volume of heated or cooled air is slowly varied in relation to zone comfort temperature demands.

In the cooling cycle, the compressor operates whenever any zone thermostat is calling for cooling, but at least one damper must be 30 to 50 per cent open before it operates. A combination heating-cooling thermostat is normally used in each zone.

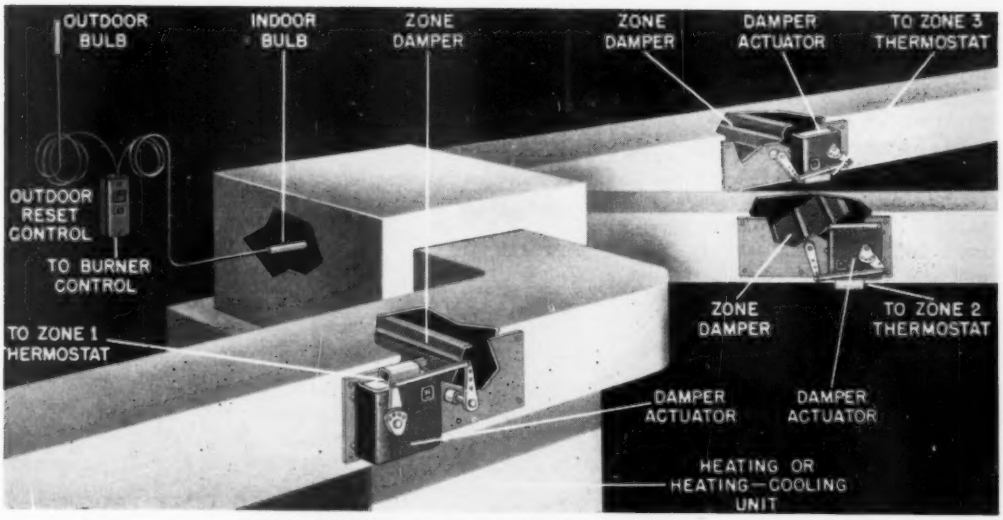
• *Modulating mixed air system*

For heating: With this method, each zone uses mixing dampers (face and bypass type) which mix portions of heated air with cooler air bypassed from the return duct system. Each zone uses one mixing damper in the zone supply duct and one mixing damper in the zone bypass from the return (taking air from the fan and bypassing it around the heating chamber).

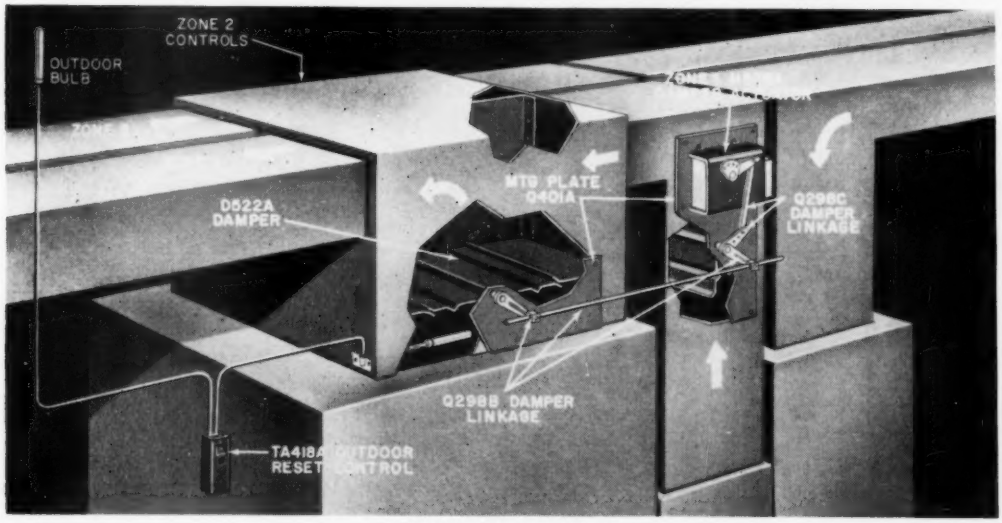
Each set of zone mixing dampers is modulated by a damper actuator which is operated by a thermostat in each area. Damper operation is continuous, with a gradual re-positioning of the mixing dampers in each zone. This method blends certain portions of heated and cooled air in just the desired amount, and delivers it through the supply duct to each area at the same rate in which heat is being lost to the outdoors. Distribution is continuous and a uniform volume of air is circulated. The temperature of supply air is continually varied according to heating load. In this way constant air circulation is not interfered with.



One damper actuator, for 2-zone-system.



Modulating air volume system, 3 or more zones.



Modulating mixed air system.

HOT WATER SYSTEMS

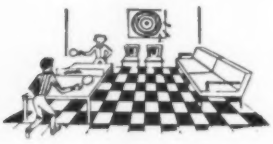
• *Separate zone furnaces*

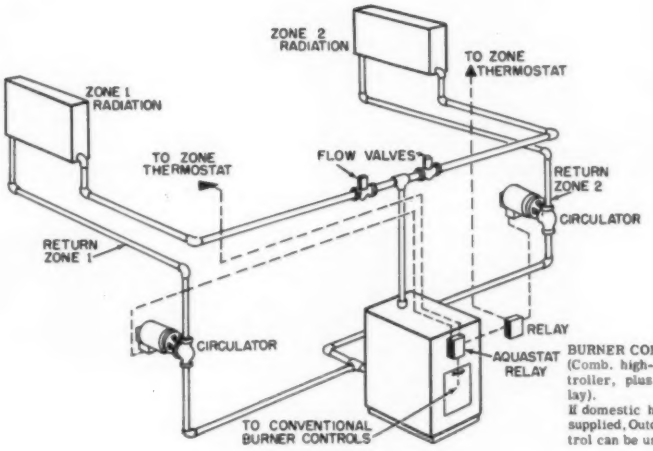
For heating or heating-cooling: In some cases space and cost factors favor the use of more than one furnace in a home, in preference to zone controls. On certain rambling-type homes, for example, two or more furnaces and cooling units often can be more economical than one large unit of comparable capacity—primarily from the standpoint of first cost.

Floor space in the basement or utility room might best be utilized when the heating system is planned for two or more furnaces. Also, long, costly duct runs with high friction loss and heat loss frequently can be avoided. With this heating or cooling arrangement, each unit serves a separate zone, and the burner or compressor is cycled by the thermostatic control system for that zone.

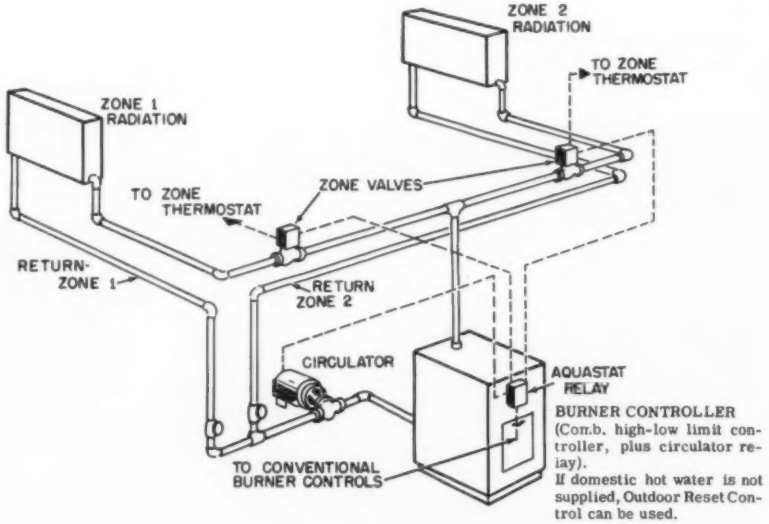
On larger installations it might be practical to have one of the heating or cooling plants serve more than one zone. In such a case, any of the zone re-balancing methods previously described can be used.

For certain localities where central heating is less commonly used, the comfort refinements of zoning might best be achieved by installing a floor furnace, space or wall heater in each room or group of rooms. Each unit would be controlled by a separate zone thermostat. The control might well be a low-voltage (Series 80) electric system, or a self-powered gas control system.





Zone valve system.



Zone circulator system.

• *Zone valve system*

Each zone has its own supply and return, with a motorized control valve installed in the supply main to each zone. Each valve is operated by a separate zone thermostat. One circulator for the complete system operates whenever any zone requires heat. Zone valves designed for this system incorporate an auxiliary switch that is actuated whenever the zone valve opens. This switch energizes the circulator relay which in turn operates the circulator.

• *Zone circulator system*

Each zone, with its own supply and return system, is served by a separate zone circulator mounted in the return from each area. The flow of hot water through the zone is regulated by the zone thermostat, which turns the circulator on and off according to heating requirements of the area.

• *Individual zone boilers*

Two or more boilers can be specified for installations where widely separated areas or long supply or return runs make it impractical to use a central heating plant. Where such problems exist, multiple zone boilers provide a highly satisfactory method of zoning. Each zone has its own boiler and radiation system, and is individually controlled by a separate thermostat.

ZONE RE-BALANCING

While multi-zone systems are popularly referred to as "zone control," "zone re-balancing" more correctly defines most of the systems covered here. A properly installed zone re-balancing system functions as a *continuous* automatic re-balancing of heating or cooling loads, as they vary from one zone to another. With a central forced air system using the modulating air volume or mixed air methods of zone control, the *"re-balancing"* is accomplished by a constant resetting of the plenum temperature according to outdoor temperature, and utilizing a modulating damper to provide a "floating" control of each zone damper.

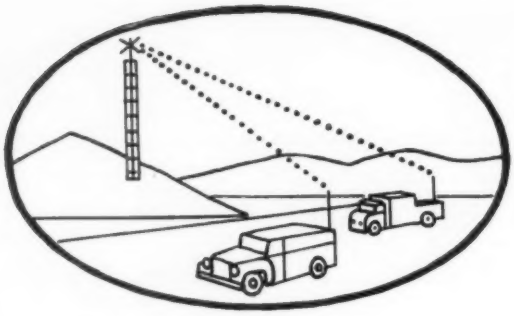
For example, in the modulating air volume zone system previously described, control features are designed into the system which provide the maximum benefit of zone re-balancing. Should internal load conditions in any of the zones be lighter than that indicated solely by outdoor temperature, the zone damper actuators would be modulating toward the closed position. Through internal switching (which will be described under "control equipment" in the next installment) the collective position of these actuators would reduce plenum temperature below the control point established by the outdoor reset control. Because the heating medium is maintained at temperatures desirable to *indoor* demand as well as load indications according to *outdoor* temperature, zone dampers are rarely in the closed position during system operation. As a result these dampers are normally resting somewhere between the partially open and partially closed position. The flow of air to each zone is *continuous*. This type of control provides continual air movement through each zone (in varying volume) and avoids undesirable shut-down periods characteristic with conventional "on-off" control.

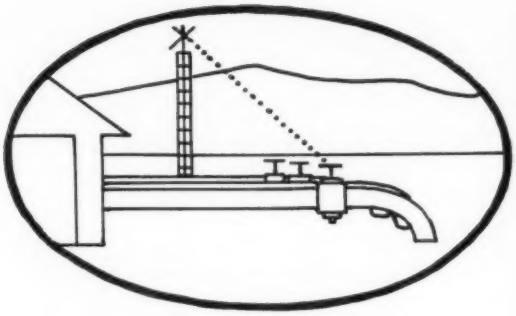
The residual heat characteristics in a hot water system also provides the effect of "zone re-balancing." The radiation remains constantly warm, but is varied in surface temperature, depending upon heat requirements for each zone. "On" cycles of the zone valve or circulator are increased in duration and frequency as heating load becomes greater in each area. ■

THE SERIES CONCLUDES WITH . . .

Part III—December GAS

1. Functions of controls used in a zone control system.
2. Detailed discussion of some control devices specially designed to operate in conjunction with other controls in a zone system.
3. The steps a gas utility serviceman might take in servicing a system equipped with zone control.





Split channel system analysis

By J. R. NEUBAUER, Radio Corp. of America, Camden, N. J.

Last month Mr. Neubauer began his analysis of the split channel system. In Part I, he discussed why more channels are needed, and the system characteristics which limit operating effectiveness. His concluding installment follows.

Modulation splatter

The least predictable value of energy appearing in a system is that of speech and extensive studies have been made of the average volume of the average talker in a communicating circuit. The purpose of these studies has been to evaluate the peak energy to the expected relative to the average energy developed, and in turn, to relate these to fixed test tone values. In order to recognize this, arbitrary modulation standards have been established. It is current practice at this time to adjust a system with an audio tone of a thousand cycles of sufficient amplitude to deviate the carrier ±10 kc in the case of a wideband system and ±3 to 3½ kc in a narrow band system. It is assumed that this reduction in amplitude from the maximum per-

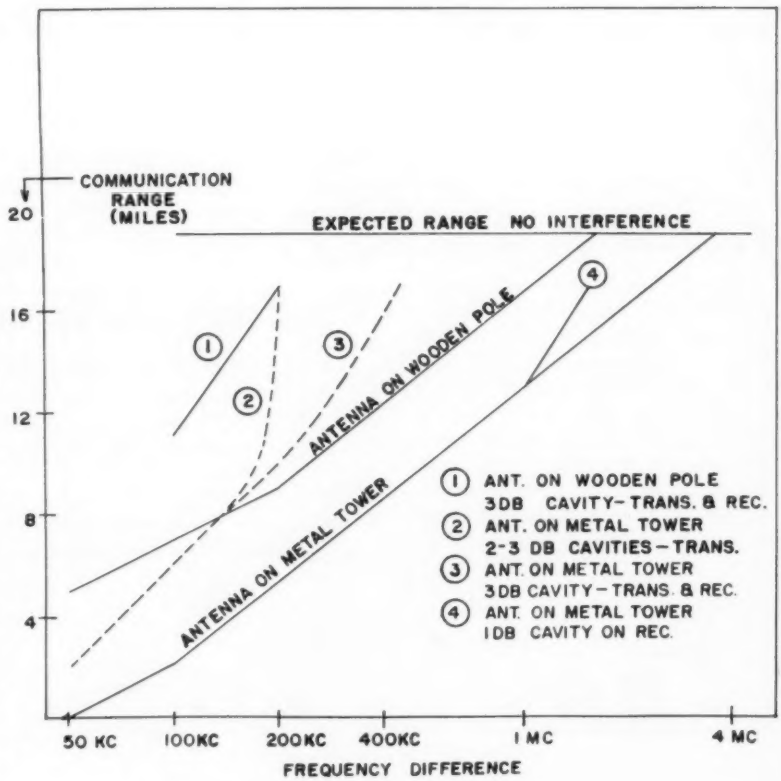
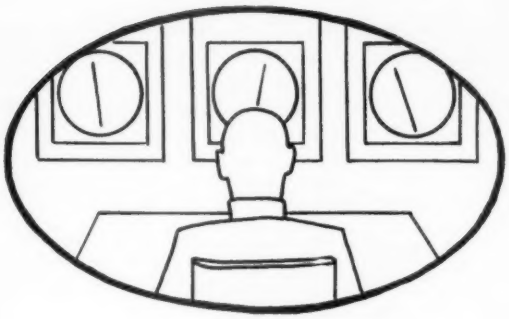
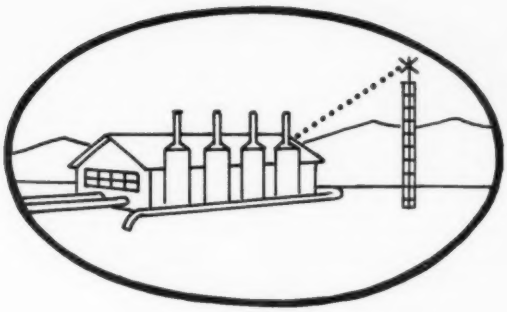


Fig. 13. System range reduction.





Part 2. Reducing interference

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missible will allow for the greater portion of the peak speech energy.

In order to further assure that the unpredictable large amplitude peaks do not exceed the deviation limits of the system, a limiter or fast-acting volume control is included between the audio amplifier circuit and the modulator input. This limiter, in order to operate at the speed required and over the range necessary, employs an amplitude clipping device which converts audio energy into a triangular wave shape. Such severe distortion produces a great many harmonics as we have previously discussed and, therefore, a filter having a rapid attenuation above the maximum desired frequency is inserted at its output. The degree of distortion is directly a function of the amount of audio input to the limiter and therefore will increase to values as high as 17 per cent r.s.s. when maximum limiting is occurring. It is too often a common practice to attempt to use the limiter as an automatic volume control to overcome the deficiencies of the talker using the system. Under these conditions, even though the output of the limiter is designed to hold the deviation to the predetermined 3½ or 10 kc, the multitudinous harmonics which are produced will generate a large number of sideband products of relatively large amplitude which have to be controlled by the aforementioned audio cut-off filter. It is therefore recommended that the input level applied to the deviation limiter be carefully controlled and that no attempt be made to use the limiter as a means of overcoming the deficiency of the talker. This will make a valuable contribution to reducing sideband splatter in adjacent channel systems. Previous experience has not shown this to be a serious problem in 60 kc allocations and this is understandable when you recognize that the guardband is 20 kc. In the split channel, assignment will be one-half of this or 10 kc and the reduction in basic deviation will not contribute proportionately to the reduction in the number of sidebands generated by high amplitude harmonic products.

TABLE 1. DETERMINATION OF FREQUENCY COMPATIBILITY

Available Channel (MC)	Col 1	Col 2	Col 3	Col 4	Col 5
A					
B	B-A				
C	C-B	C-A			
D	D-C	D-B	D-A		
E	E-D	E-C	E-B	E-A	
F	F-E	F-D	F-C	F-B	F-A

Any identity determines that one of the sequence in those groups must be changed.

To check, successively subtract last row, column 5 to 1 from last channel. The results should equal the channels E back to A.

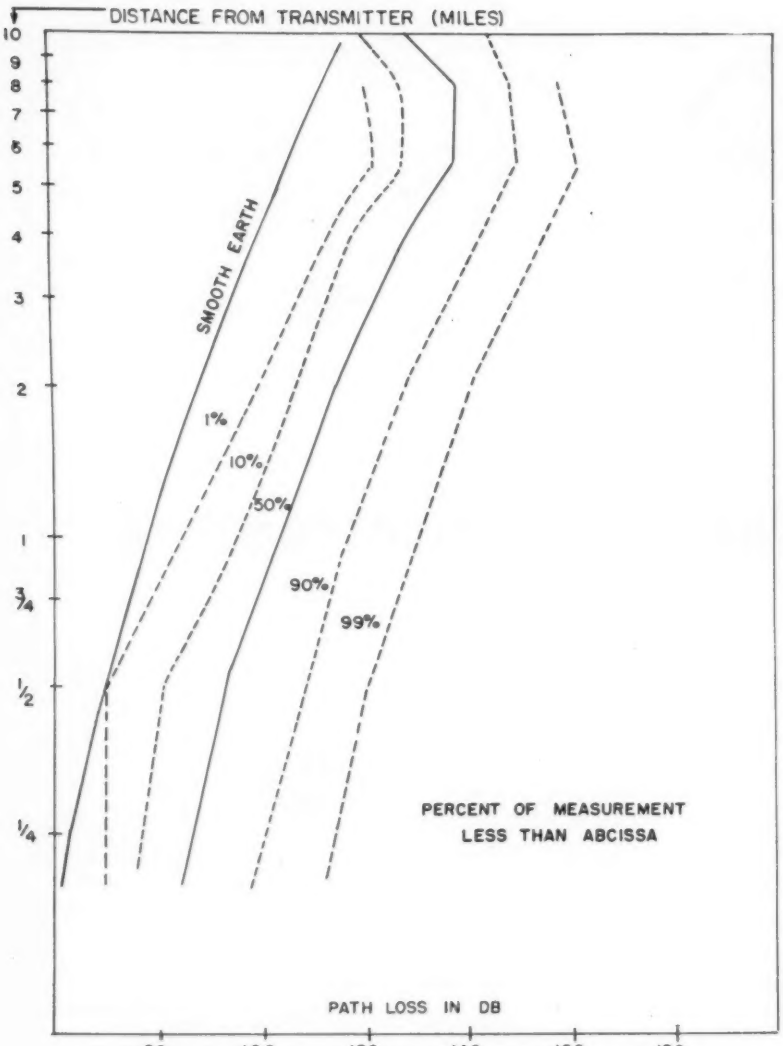


Fig. 14. Typical path loss in metropolitan and suburban areas.

Transmitter noise

This form of interference is extremely broadband in nature because of its early origin in the transmitter circuits and therefore one method of attenuating its output in the transmitter is to improve the selectivity of the transmitter output circuit. At present, this is most effectively accomplished with a high Q cavity which attenuates outputs beyond the required band of the transmitter 30 to 40 db. It must be recognized that this is at the expense of from one-half to 5 db. in the transmitter output; in other words, a loss of power of 3 to 1. Therefore, in every case where this technique is employed, the overall system requirements should be reviewed and this power loss restored, if possible, through the use of high gain antennas.

A significant contribution to the reduction of noise in the transmitter can be made through careful design of the input circuits to the amplifier and modulator. In the case of mobile equipment, recognition of the pick-up of vehicle electrical system interference on the microphone circuits must be made. The use of a dynamic type microphone in preference to the carbon should be considered. In addition, electrical system interference can get into the audio input circuit as a consequence of poor power cable installation, such as ineffective shielding, ineffective grounding and indiscriminate placement of cables. In the case of base stations, it is well to evaluate telephone line and control amplifiers incorporated in remote control systems. Of more importance than previously will be adequate regularly scheduled maintenance of mobile equipments to minimize the noise contributed by the dynamotor and vibrator power units, as well as microphonic or other forms of noisy tubes.

Intermodulation

To reduce this most difficult form of interference will require application of every possible technique, and the minimum interference to be experienced will be limited in the end by the coupling provided between the systems, since this type of interference generates a product which falls within the desired passband of the receiver. In the case of the transmitter as well as the receiver, any improvement of the selectivity of the transmitter output or the receiver input will make a direct contribution in decibels of improvement. Also, in both cases of the transmitter and the receiver, a careful selection of the operating frequency will be necessary.

Referring to *Table 1*, it is possible to determine by a moderate amount of simple calculation, the potential interfering frequencies. In the left-hand column should be listed all of the frequencies in use within a radius of 3 to 5 miles of the desired station locations. They should be listed in the declining order of their magnitude. This should then be followed by successive subtractions as indicated in the five columns shown in this example. This technique is not limited, however, to five channels, but may be extended in the same stair-step fashion to an indefinite number by following the established progression. In the event that two of the resultant subtractions are equal groups, one of the frequencies involved in these must be eliminated or moved to another value and a re-calculation performed. Before doing this, however, the calculation should be checked as indicated in the table by successively subtracting the values in reverse order of the

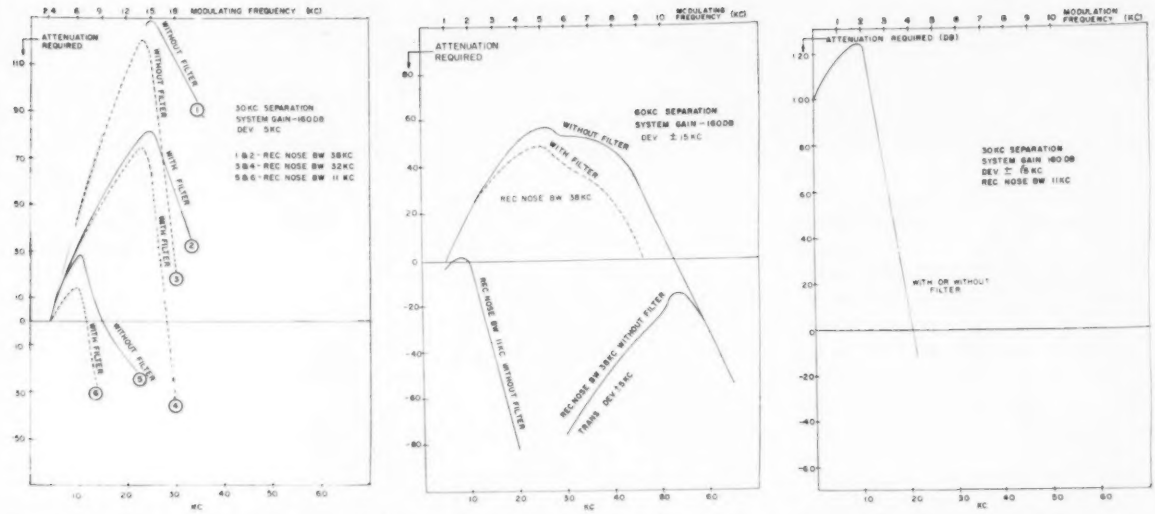


Fig. 15. Minimum permissible coupling—A (left)—30 kc channel separation; B (center)—60 kc channel separation; C (right)—30 kc separation WB transmitter, NB receiver.

last row from the last channel value. The results of this successive subtraction should give values equal to the channel frequencies in the reverse order of the first column, or in other words, in ascending magnitude. In the case of the transmitter, it is well to determine if any considerable amount of second harmonic energy is present in the final amplifier, and if so, efforts should be made to suppress this to the maximum degree.

In addition, it is possible, in specific cases, to reduce the amplitude of the frequency which is being injected into the transmitter causing the interfering frequency by means of a high Q trap paralleled on the transmission line with a proper impedance matching harness. This technique is possible where sufficient frequency separation exists: otherwise it will deteriorate the transmitter performance, due to the flanking effect on the transmitter output. It does, however, have the advantage that the insertion loss can be improved over the series cavity arrangement for an equivalent amount of undesired signal rejection. A very effective technique which can be employed in the case of receivers is the use of "notch" type crystal traps. These are very effective in instances where only two interfering frequencies are involved and they are sufficiently removed from the desired bandpass of the receiver to avoid the flanking effect caused by the very sharp skirts of the crystal notch. These traps will provide up to 20 db. of undesired carrier rejection which may be sufficient in conjunction with other methods to reduce the amplitude below the intermodulation generating level.

As has been indicated in the previous discussion, the probability of this form of interference will be high and the difficulty of its suppression will compromise many installations. A more drastic solution is to group all the transmitters of a given general location at one antenna farm and to group the receivers at another with sufficient separation between them to attenuate the resultant product carriers. Even though this may be effective in reducing intersystem interference, you will still be obligated to assure the amplitude of the generated products at the transmitter site do not exceed the FCC limitations for spurious emissions. This is defined in the Rules and Regulations for each service under the title "Emission Limitations" and is directly related to the maximum authorized plate power input to the final radio frequency stage. The commission is changing this to a formula value determined by the relation $43 + 10 \text{ Log}_{10}$ PO. In other words, the amplitude in dbw. must be —43 dbw. absolute power or less at 100 per cent or more of the authorized bandwidth

Desensitization

This is another characteristic which can be most effectively corrected by improvement of the transmitter output and receiver input selectivity. It is also alleviated by the use of notch type crystals. The basic requirement is to reduce the amplitude of the undesired energy appearing at the receiver input and this must precede any active stages of the receiver. As in the case of all other forms of interference, any technique which will increase the decoupling between the systems will be effective. Such techniques are discussed in a later paragraph.

Spurious emissions

Modern design of transmitters employs a low pass filter to reduce the amplitude of the spurious carriers which occur above the transmitter frequency in the output circuit. In addition, improvement in the selectivity in the output circuit will further reduce these signals in the antenna system. However, these frequencies will also escape from the transmitter by other routes and therefore care will be necessary in the installation of the equipment to assure that the grounding of the system is adequate and that all critical circuits are properly shielded.

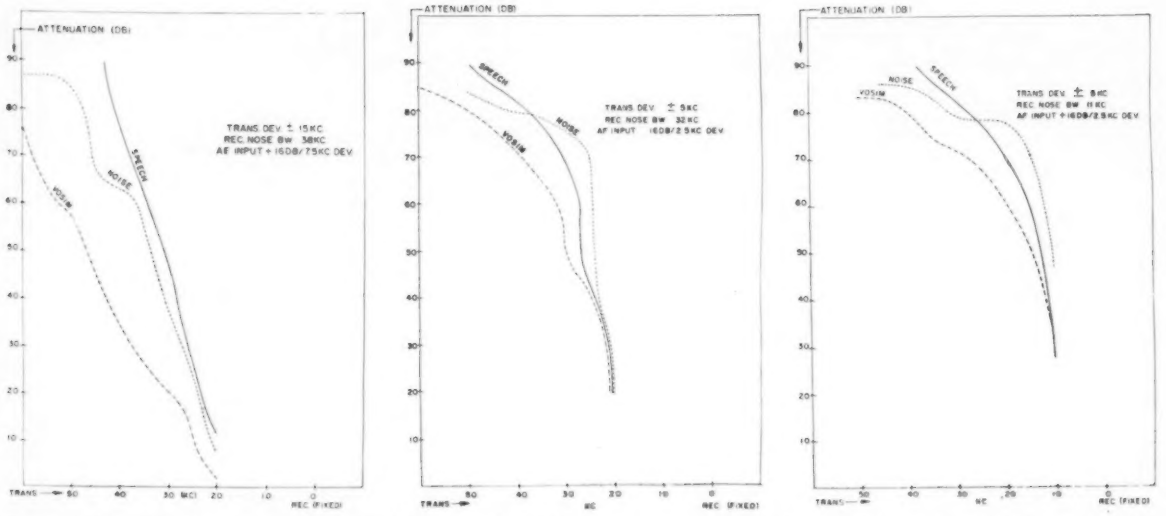


Fig. 16. Adjacent-channel interference attenuation. A (left)—wide band system; B (center)—modified wide-band system; C (right)—narrow-band system.

In cases where interference is experienced, every effort should be made to optimize the installation shielding beyond that which might ordinarily be considered normal.

Spurious response

This characteristic is again one whose effect can be reduced by improved selectivity in the input to attenuate the interfering frequency. If the frequency of this interference is known, a notch type crystal filter trap will be effective. Again, this is a case of optimizing shielding and grounding to reduce the potential leakage of interfering energy into the "back door" of the receiver circuits. In referring to *Table 3*, it will be noted that there are many combinations involving internal amplifiers and oscillators of the receiver which will produce spurious response. As previously noted in all other instances, decoupling is the final and most effective tool we may employ.

Other system design considerations

The following recommendations are predicated on experience gained in the design of many systems in which interference has been present. The practices do not particularly apply to any one but will make a general contribution to an improvement in the reduction of forms of interferences between systems.

1. *The system* should be designed to utilize minimum transmitter power with maximum directional and gain characteristics in the antenna system. This will have the effect of reducing the antenna aperture, thereby making it less susceptible to interference radiation as well as reception. Every effort should be made to study the desired area of coverage and a radiation pattern selected which will be limited to this area.

2. *Continuous* coordination between users of the transmitter and receiver frequency adjustments and the modulation levels makes a significant contribution which can be further enhanced by careful geographical and frequency allocation. Particular emphasis should be placed on the system to system relation rather than on absolute values, for in the last analysis, this condition will be controlling.

3. *Careful attention* to installation of antennas and transmission lines will also make substantial contributions, particularly in providing decoupling between systems. It has been found that where possible, inversion of ground plane antennas with respect to each other will provide up to 6 db. of decoupling. In cases where they are employed, coaxial transmission lines mounted on the same support can be decoupled up to 10 db. when separated as little as 6 inches, with proper terminations. Again, where possible, it is preferable to use wooden supports to reduce reflection effects, thereby improving the decoupling and in cases where guy wires are used they should be detuned by careful attention to the continuous lengths permitted between insulators. The installation of a ½ in. mesh ¼ in. screen (grounded) will provide up to 7 db. of decoupling. In order to compare the effects of various types of supports and techniques of improving selectivity, reference should be made to *Fig. 13* which shows the improvement in coverage which can be obtained with various types of installations for given frequency separations in systems.

Conclusions

In reviewing the numerous inter-system conditions which will produce undesirable effects, it will be noted that practically all of them are contingent on the proper coordination of frequency assignments. During the early transition period before serious saturation takes place, this problem will not be too apparent by experience; however, if there is not sufficient early planning, it will become an increasingly more aggravating situation as the maximum utilization of the split chan-

nel potential is reached, at which time if sufficient early coordination has not been effected, the condition will be well nigh hopeless. It is the moral obligation of both the manufacturer and the user to make every effort to cooperate with frequency allocation committees and the FCC to obtain the best long range planning possible. Some relief from the channel congestion will be had if the users of communication systems will elevate their maintenance standards to the highest degree practicable.

This will be effective in reducing modulation splatter, system gain degradation and other forms of adjacent channel interference. It is apparent that even though care has been exercised in the selection of frequencies and adherence to good maintenance practice, that if the operating techniques employed are not designed to reduce the unnecessary transmission time by simplification of message techniques and traffic handling, much of the advantage gained will be lost. In many cases, a final solution will be in the geographical separation of the systems, either as groups or individual units. This, no doubt, will prove to be one of the most difficult things to achieve satisfactorily in congested areas, since good transmitting and receiving sites are not plentiful.

From what we have said previously, it will be evident that the effort of coordination must be carried over into the actual station installations for circumstances will often require several different users to share a common location and therefore it will be desirable that they mutually make every effort to protect each other against unnecessary interference.

To assist in planning systems, *Table 2* has been prepared to give the approximate physical separations required to assure minimum interference. The system characteristics of transmitter sideband energy receiver selectivity characteristics, and minimum thresholds of interference have been translated into terms of decibels of attenuation required which, in turn, have been given equivalent physical separations in miles or feet. It will be noted that two sets of these data are supplied; one which is purely theoretical and the second which is adjusted for the 50 per cent median of measured loss in actual field tests that have been made. The data in this table are predicated on a system having 160 decibels of gain which consists of 14 dbw of transmitter power output and a receiver having a useful sensitivity threshold of —146 dbw. In other words, the values will be in terms of the physical separation required to reduce the amplitude of the interference to the receiver threshold and are based on plane earth theory in the first instance. These values are then modified by referring to *Fig. 14* which is extracted from a paper by W. R. Young. This graph details typical path loss values in metropolitan and suburban areas determined by means of a rapid measuring device whose total output is summed up in the set of curves which are related to the theoretical smooth earth attenuation.

It should be recognized that other terrain features may control in many cases. It is particularly significant to note that in this table, those conditions which are most difficult to control are the receiver intermodulation characteristics and the transmitter spurious output. In the case of the receiver intermodulation, this will be a frequent offender. However, the number of transmitter spurious components falling within the band are not as frequent in occurrence. In any event, it appears that outside of these two limitations, the minimum separation between systems should be on the order of 1000 ft, unless other techniques are employed to reduce the interference. Each of the things which has been suggested previously can reduce this physical separation by an appreciable amount.

Referring again to *Table 1*, we will recognize the frequency and separation limit which will obtain in the mixture of wide and narrow band systems and we must also accept the deterioration of performance which is apparent in *Fig. 15A, B* and *C*. It is also possible to use *Fig. 16A, B* and *C* to further determine the limit of effective attenuation of adjacent channel interference in mixed systems.

The economics of modification of existing equipment and the cost for the additional interference attenuation devices and extra cost of installation and maintenance will definitely become a serious consideration, but if it is desired to have interference-free reception, these costs will have to be accepted.

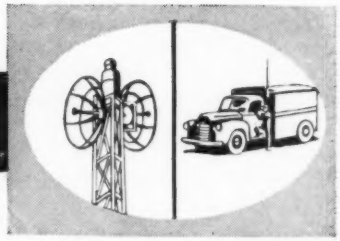
It should also be recognized that a compromise minimum performance standard will have to be tolerated since, in spite of all efforts we make to reduce interference, there will be a limit between the desired performance and the degree of effectiveness which can be accomplished since so many items are involved. As has been noted in the discussion of geographical separation requirements, the availability of adequate

Continued on page 67

TABLE 2. INTERFERENCE SEPARATION REQUIREMENTS

Type of Interference	*DB Atten. Req'd.*	*Plane Earth Distance*	*DB Adj.*	*Distance Adjusted for—50% Median of Measured Loss*	*Remarks*
Modulation splatter	78	0.55 mi.	55	500 ft.	
Transmitter noise	81	0.65 mi.	58	700 ft.	
Transmitter IM	66	0.27 mi.	42	110 ft.	For trans. separated 0.6 mi. having equal power (or 560 ft. for Adj. Values)
Receiver 1M	98	1.75 mi.	71	0.36 mi.	For trans. having equal power of 15W.
Transmitter spurious	100	2.0 mi.	74	0.43 mi.	
Receiver spurious	71	0.36 mi.	47	190 ft.	
Desensitization	69	0.32 mi.	45	150 ft.	
Receiver radiation	11	102.8 ft.	—	102.8 ft.	

communications



By FRANK CHAPMAN

FCC studying allocation evidence

FEDERAL Communications Commission officials and staff have closed the hearings on the future allocations of microwave radio frequencies, and now are immersed in the back-breaking job of sifting evidence and recommendations.

The lengthy hearings ground to a close with the Electronics Industries Association—successor to the Radio Electronic Television Manufacturers Association (RETMA)—telling the commission that new developments in microwave technology will provide adequate space for a "liberal" policy of licensing new private microwave systems "under a disciplined pattern of spectrum control."

The association warned that such a liberal policy will in fact be needed to spur development of new and better microwave techniques and equipment.

Among the new developments now in the electronic laboratories, according to Elmer D. McArthur, manager of high frequency electronic research at General Electric's Schenectady plant, are:

Transmitter and receiver tube development in the 4- to 12-kmc range, which will be produced in the near future; development of microwave technology in the 5- to 12-kmc and 30- to 50-kmc frequency ranges; more efficient cathodes; specialized microwave circuits, and special materials, vacuum and ceramic parts.

Daniel E. Noble, executive vice president of Motorola Inc., speaking for the Electronic Industries Association, told the commission that a "vigorous and healthful independent microwave industry cannot exist without the 'freedom of choice' principle operating within a liberal policy of licensing eligibility," which would permit a potential microwave user to have a choice of operating his own system, leasing facilities, or using a common carrier system.

Mr. Noble, speaking in favor of the widest possible licensing of private microwave users, said that if, because of too restricted eligibility for private systems, the microwave manufacturing industry must retrench to a point where it is no longer an economical source of supply for present users, "the will of the commission (to promote a sound industry) will be negated."

The association also supported voluntary sharing of point-to-point microwave systems, but not mandatory sharing. It also opposed new rules which would have the FCC consider availability of common carrier facilities as a condition of eligibility for private licensing because it would restrict the freedom of choice and thus harm the industry, and opposed sharing of bands between common carrier and private systems.

Another peek into future microwave developments came when the commission questioned Sidney Topol, an executive of Raytheon Manufacturing Co. Mr. Topol told the commission that research indicates that tropospheric scatter will be an improved method of microwave transmission in some cases, especially over large water areas, but will not, because of cost and scatter effects, replace relay microwave. Some rules governing this new technique will probably be needed soon, he indicated.

The commission expects the first of the proposed regulations resulting from the microwave allocation study to be out early next year. It is unlikely that any existing users of microwave will be denied licensing rights, although some restrictions may be placed on the uses to which they may put their systems.

Antitrust warning issued

The Justice Department has entered a second proceeding before the FCC to warn of possible violation of the antitrust laws in connection with proposals by the American Telephone & Telegraph system.

The department has warned the FCC that permitting AT&T to enter the lease-maintenance service for mobile radio equipment by accepting proposed rates would "substantially curtail or eliminate vigorous and healthy competition in this youthful industry . . . and would violate various provisions of the antitrust laws."

The department added that permitting AT&T to lease and maintain mobile equipment would violate a 1954 court decree which ended a long antitrust suit against the phone company.

AT&T has asked the commission to pass on rates it proposes to charge for the new service, and if these rates are accepted for filing, the court order would not apply. The company contends the antitrust decree should not be a factor in the case; that permitting the utility to enter the field of leasing mobile equipment would mean more, not less competition, and that the utility would be regulated and thus have to give service to all comers. ■

Split channel

(*Continued from page* 65)

sites for good system coverage is destined to reach an early limit. This will naturally force users to a higher investment in antenna supports.

In anticipation of this situation, manufacturers have been currently producing equipment which can be easily modified to operate in either wide or narrow band systems. This change can be effected by the installation of a suitable kit of parts and a new crystal of suitable stability characteristics for the transmitter and receiver. It is recognized that, at this time, there are definite economic limits to the modification of units more than five years old since in some cases, considerable circuit revisions would be necessary. All present users now operating systems will have to accept the responsibility of doing a thorough clean-up job which will include establishment of reduced modulation levels and precise frequency adjustment, as well as reduction of noise effects and adoption of improved operating techniques to reduce the traffic load and probability of interference.

In the requirements of the two- and five-year intervals provided in the FCC docket, it would appear that the maximum transition difficulties will reach their peak in approximately two or three years. We cannot conclude this discussion without recognizing that it is anticipated that if the industry continues to grow at the same rate, that further channel splitting, not only in this band, but in all the mobile bands as well, will be required.

There has been no attempt in this paper to evaluate many minor conditions which will be experienced but it is believed that if a conscientious effort is made to follow the practices recommended and to make an adequate effort to recognize the difficulties by careful system analysis that much of the aggravation of the coming split channel era will be avoided. ■

New RIDGID 4PJ
Geared Threader
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"...It's Safe, Boss...
I Don't Need To Watch It
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Patents Applied for
RIDGID 400A Power Drive with Universal Drive Shaft operates 4PJ Threader on 2½" to 4" pipe held in Tristand Chain Vise, all RIDGID products.

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GAS news

Rate base issue raised at joint hearing

The issue of whether public utilities should be allowed to figure their rate bases in the same manner as they do accelerated depreciation under federal income tax regulations was raised at a recent hearing conducted jointly by the Missouri and Kansas state utility regulatory bodies.

Empire District Electric Co., Joplin, Mo., seeks to have the accelerated depreciation doctrine figured into the base for increased rates. Lawyers for cities opposing the rate increase say the acceptance of the doctrine would result in a distorted earnings picture.

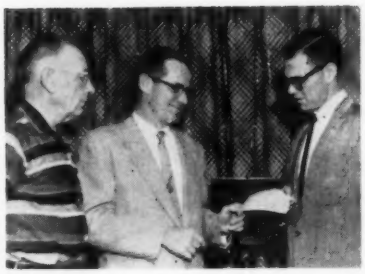
The company's investment advisor explained the accelerated depreciation theory enables a corporation to charge off larger amounts of the cost of capital improvements in early years to lower income taxes then and raise them later. He said utility commissions have ordered companies to "normalize" the rate for accounting purposes.

"Normalizing" was defined by him as breaking income taxes into two parts. One part is the amount actually paid in income taxes under the fast tax write-off doctrine. The other is the difference between that payment and what the tax actually would have been if normal depreciation methods had been used.

"In the case of public utilities," the investment expert testified, "accelerated depreciation can be beneficial to the utility only if the income account is 'normalized,' if the property constructed with deferred tax cash is included in the rate base, and if the allowed rate of return is the same as it would be without accelerated depreciation."

He expressed belief that all of these factors must be present if the company is to receive fair treatment at the hands of the utility commissions.

"If earnings are not normalized, the utility has no additional cash for expenditure on plant and equipment," he said. "If earnings are normalized and property constructed with deferred tax cash is

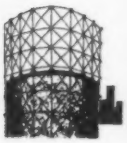


A $250 check is presented to prize-winning promoter Dick Sievers (right), Central Electric & Gas Co., Lincoln, Ill., by John B. Selover, Robertshaw-Fulton Controls Co. The company sponsored a contest among gas utility promotion men for the best local participation in this year's Mrs. America competition. Mr. Sievers, who is director of advertising and publicity for Central Electric, won in the 50,000-100,000 meter class. Col. L. D. Densmore, vice president and general manager of Central Electric, witnessed the ceremony.

More than

2 MILLION FEET OF ½ INCH KRALOY SERVICE PIPE

already installed



Since 1945 more than two million feet of one-half inch Kraloy Plastic Pipe has been installed for natural gas service lines. This one-half inch PVC pipe has done a job superior to that of ¾ inch, and larger pipe, when made of other materials.

One-half inch Kraloy PVC Pipe can also supply more than an adequate volume of natural gas to your customers. Kraloy can do this because of its mirror-smooth interior walls which result in an extremely high C factor.

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included in the rate base but the allowed rate of return is reduced, the tax paying utility has not benefited."

Gasoline from natural gas experiment called off

"We have determined that the Brownsville plant cannot make gasoline and chemicals from natural gas at present market prices as cheaply as they can be made by other prices," said J. H. Forrester, president of Amoco, a Standard Oil Co. (Indiana) subsidiary, when he announced the shutdown of the Texas plant.

The world's first plant for manufacture of gasoline from natural gas will be shut down as uneconomical within the next few months. Reduction of the work force began in October.

The Brownsville synthetic gasoline plant was completed in 1950 by Carthage Hydrocol Inc., aided by an $18.5 million loan from the Reconstruction Finance Corp. It was closed in 1953 because of difficulties with processes and mechanical problems. It was reactivated in 1954 by Amoco and has been in operation since 1956.

Mr. Forrester said production has been "at a very low level," although they have proved the technical soundness of the process.

Greeley negotiating for Central West Utility

Greeley Gas Co., Denver, has entered into negotiations to purchase the Kansas properties of Central West Utility Co., Kansas City, Mo. According to Greeley's president, Gerald L. Schlessman, the transaction involves $800,000.

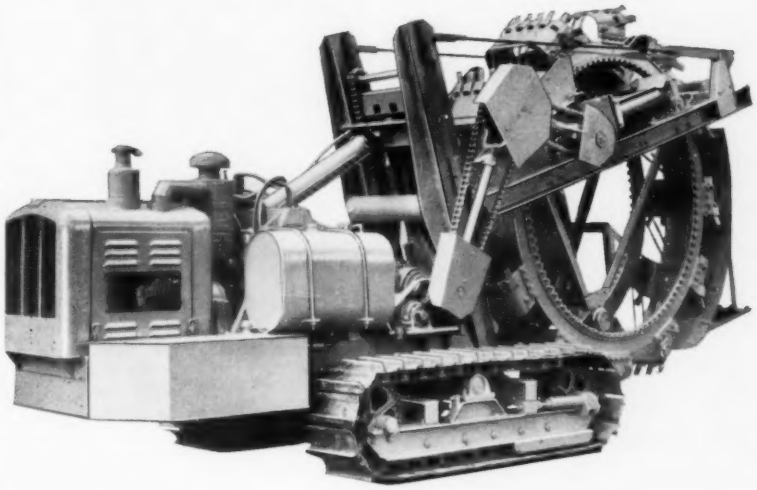
Central serves Bonner Springs, Eudora, DeSoto, Marion, Peabody, Hillsboro, Tampa, Ramona, Lincolnville, Lost Springs, Herington, Wilsey, Lake of the Forest, Basehor, and Delavan, and wholesales to Home Gas Co., Council Grove, Kan.

The deal adds 6500 customers to Greeley's present 13,000. Fifteen Colorado communities are served by Greeley from divisions in Greley, Canon City, and Craig.

Vacuum cleaner removes scale from gas lines

A self-contained, king-size vacuum cleaner is being used by B. C. Electric to de-scale pipelines moving natural gas instead of manufactured.

trench widths: 20 TO 32 INCHES



with NEW 170 wide-wheel Trenchliner

- **wide wheel frame — cutting widths from 20 to 32"**
- **maximum digging depth 5'9"**
- **hydraulically-driven conveyor — belt speeds independent of digging wheel speeds**
- **30 digging speeds from 12" to 25 lineal feet per minute**
- **heavy-duty cast-steel buckets**
- **double-point "Tap-In" teeth — self-sharpening, reversible**
- **quick-change gumbo buckets**
- **retractable bucket-cleaner**
- **hydraulic wheel-hoist on power-tilt mast**
- **standard tractor crawlers — 16" grouser-type treads, or 12" flat shoes optional**
- **choice of gas or diesel power**
- **all main gears enclosed in oil bath; all main shafts on antifriction bearings**

Now, another wheel-type Trenchliner joins the big Parsons line — a new 170, with extra-wide wheel frame. Developed to meet the demand for wide work range in a medium-size machine, it digs up to *32 inches wide,* at depths to 5¾ feet. With all this extra capacity, you get smooth, positive wheel control.

Hydraulic power raises and lowers the wheel on vertical mast with fractional-inch accuracy — and tilts the mast for traveling or trailer-loading. New hydraulic control system on conveyor gives belt speeds up to 600 feet per minute — *completely independent of digging wheel speeds.* Belt easily handles maximum yardages from the extra-wide wheel — puts spoil bank well back beyond edge of trench. Better have Parsons distributor demonstrate what this new 170 will do for you!

Other sizes range from a smaller wheel model to "big-inchers" and "middle-inchers" — also, ladder-types on crawlers, and on rubber.

mail to: PARSONS Company, NEWTON, IOWA

Send us more information on new 170 wide-wheel Trenchliner

NAME ..... TITLE .....

COMPANY ..... DIV. .....

STREET .....

CITY ..... STATE .....

GAS P793

PARSONS TRENCHLINERS®

A DIVISION OF KOEHRING COMPANY

When the Vancouver, B. C.-based company switched from the use of manufactured to natural gas, service crews uncovered a possible source of supply failure. Manufactured gas had formed a hard scale on the interior surfaces of the gas pipes. The scale had remained stable with manufactured gas, but with the advent of natural gas, it was beginning to decompose into dust and flakes which could travel down the pipe and possibly block the users' immediate supply.

B. C. Electric removes scale from gas lines with this self-contained king-size vacuum cleaner.

Unless some way could be found to remove this scale, B. C. Electric was faced with the immensely costly prospect of digging up and replacing the entire network of pipes.

Actual dislodgement of the scale was relatively easy. The company found a power-driven version of the plumber's "snake" could be inserted in the pipe and rotated down its length. The snake would cover up to 1200-ft lengths of pipe and cut loose all the scale, dropping it into the pipe. This still left the problem of removal unsolved. The obvious answer of blowing the material from the pipe was not the solution because the scale has an exceptionally unpleasant odor and is slightly inflammable.

To solve the problem, B. C. Electric called in Conveyair of North Vancouver, specialists in the design and manufacture of pneumatic materials handling and conveying equipment. Engineers studied the problem from all angles before recommending the design and construction of a compact trailer unit equipped with the vacuum cleaner. The king-size cleaner offers two stages of cleaning, yet occupies platform space of only 7 ft x 7 ft x 6 in.

The welded steel trailer incorporates a 4-ft cylinder, air-cooled, industrial motor driving a high capacity vacuum pump piped to a vertical separator and bag filter. The scale is drawn through the separator and filter via a flexible connection inserted in the gas pipe and then dropped directly into airtight compartments built into the trailer body. From these compartments the scale is easily extracted for disposal purposes through leakproof doors.

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TEST THIS IMPORTANT DEVELOPMENT ...

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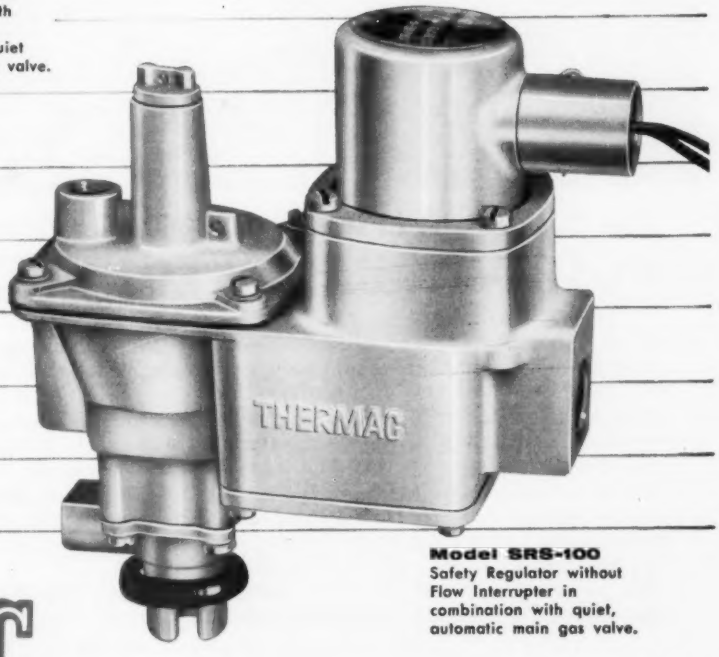
Model SLS-100
Safety Regulator with Flow Interrupter in combination with quiet automatic main gas valve.



Model SRS-100
Safety Regulator without Flow Interrupter in combination with quiet, automatic main gas valve.

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New Colorado company okayed to issue shares

The Colorado PUC has authorized the Rocky Mountain Natural Gas Co. Inc. to issue and sell 1,023,701 shares of common stock with a par value of $1.

Headed by Ernest C. Porter, the firm headquarters in Denver and distributes gas to Nunn, Wellington, and Ignacio, Colo. It holds franchises in Dove Creek, Naturita, Nucla, Walden, and Silt, Colo.

Corey-Nelson Investment Co. is handling promotion and sales of the stock issue.

Other directors of the company are: Dr. W. C. White, Denver; Price Briscoe, Idaho Springs; W. K. Hurd, Pueblo, and John M. Reed, Lakewood.

Eastman Chemical Products Inc. is celebrating the first quarter century of tenite plastics. Shown here are several lengths of lightweight pipe extruded from Tenite butyrate.

This Quantometer at Standard Magnesium means

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At the Tulsa plant of Standard Magnesium Corp., this Quantometer analyzes magnesium faster—and to a greater degree of accuracy (within .0001%) than any other method.

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Southern Union joins in home safety program

Southern Union Gas Co. is cooperating with the women's department of the chamber of commerce and the women's auxiliary to the El Paso County Medical Society in promotion of an accident prevention program in the interest of family safety.

Southern Union's Davis Butler, manager of the company, said the program is designed to call attention to common types of home hazards and the means of eliminating them. The company will sponsor a series of newspaper ads, TV and radio announcements in the El Paso area. In addition a booklet will be distributed through local schools, churches and civic organizations for a more detailed study of home accident prevention.

The 1957 home safety program is being sponsored by Southern Union and local civic groups in the utility's service areas in New Mexico, Arizona, Colorado, and western Texas.

Ontario line joining Tras-Canada system

Construction was expected to be completed late last month on the 33-mile, $750,000 line bringing

natural gas to Lindsay, Ontario.

Construction of the distribution system, estimated to cost $600,000, will begin shortly. Consumers Gas Co. of Toronto has the certificate of convenience and necessity to serve Lindsay.

Three spreads worked on the line, which will join up with the 20-in. Toronto-to-Montreal section of the Trans-Canada Pipe Line north of Newcastle. Contractors for the section from Lindsay town line to Lifford is Mid-Canada; for the middle section from Lifford to Pontypool, F. E. Shaw Ltd.; and from Pontypool to the Trans-Canada line, R. B. Somerville.

Gas business threatened by TVA expansion plan

The Tennessee Valley Authority (TVA), a continuing monument to the public-vs-private power fight, is attempting an expansion that critics claim would "blast holes" in the natural gas business.

Legislation due to come before Congress next year would authorize TVA to sell revenue bonds to the public and the government in unlimited amounts as long as no more than $750 million was outstanding at any one time.

The bonds would be tax-exempt, with payment guaranteed by the taxing power of the government. In addition, funds would continue to be appropriated by the government to operate the vast hydroelectric TVA system.

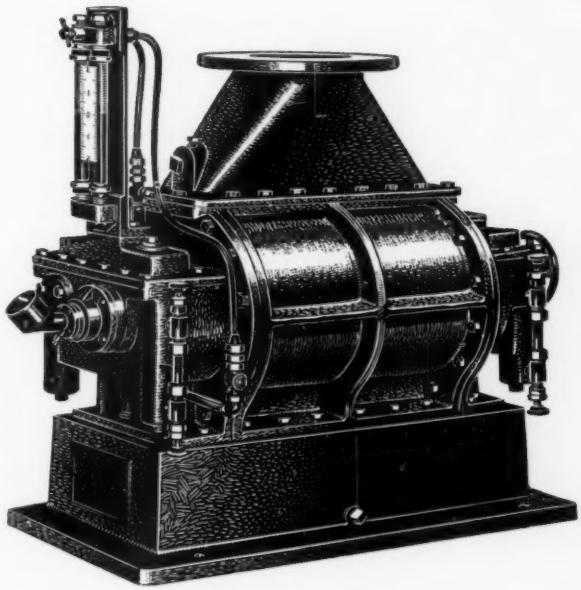
"Tax-supported electricity (from TVA) has replaced natural gas in homes and industries throughout most of the TVA service area," the U. S. Chamber of Commerce says. In 1956, spokesmen for President Roosevelt's "grand experiment" at TVA said that more than 180,000 homes would be heated by TVA electricity this year.

As a result, the use of natural gas in the TVA area has not increased at a rate comparable to the increase in communities which are much farther from the sources of natural gas.

The financing measures, one of which has already been passed by the Senate, would permit the TVA to expand almost without limitations, the Chamber claims.

"Then, almost surely, Bonneville and other public power agencies would be allowed to do the same thing," the TVA opponents warn.

Gas distributors in other areas



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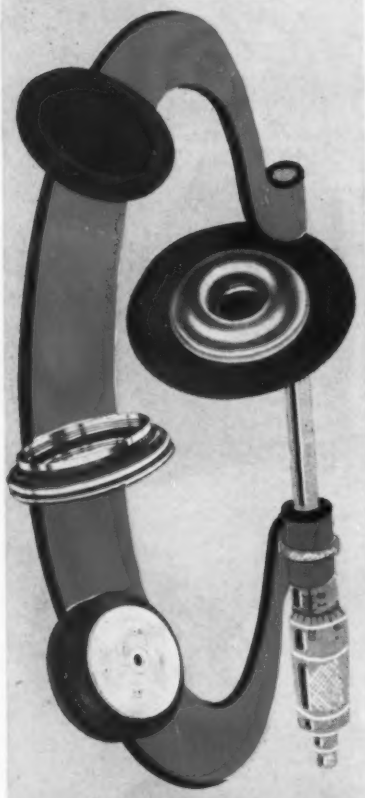

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of the country would eventually find themselves fighting the same type of subsidized competition that TVA area distributors now face, the opponents say, if these bills are passed.

Ontario Fuel Board expands inspection service

Inspection service of natural gas installations is being expanded by the Ontario (Canada) Fuel Board.

At present, regional inspectors are being placed in the field and regional offices opened at Hamilton, Windsor, Ottawa, and other points. A. C. Crozier, chairman of the two-year-old board, explained that the inspection service is part of the government program to bring all fuel installations under safety control.

East Ohio looks to 50% increase in gas demand

East Ohio Gas Co. anticipates a 50 per cent increase in gas demands in the next 10 years in its northeastern Ohio territory.

On the basis of a report by Robert Heller & Associates, the company has assigned financial experts to study means of raising $100 to $200 million to pay for additional facilities that may be needed by 1966.

East Ohio's new president, Robert W. Ramsdell, said much of the information leading to the conclusions was based on interviews with officials of more than 700 industrial customers of the company.

According to the study, steel plants of the Cuyahoga and Mahoning river valleys and of the Canton-Massillon sector will need nearly 67 billion cu ft of gas by 1966 compared with a little under 40 billion in 1956. Steel capacity in the area is expected to rise from 16.6 million net tons in 1956 to 21.3 million in 1966.

GAS news notes

Furane Plastics Inc., Los Angeles, has formed a new division devoted to the selling of its adhesives and sealants. The adhesive division will be backed up by an aggressive production research and development group.

Neptune Meters Ltd., Toronto, has purchased all outstanding stock of Cleveland Meters Ltd., England. This purchase is another step in the expansion and diversification program of the parent company, Neptune Meter Co., New York. In the past five years, Neptune has acquired Electronic Signal Co., Cox & Stevens Electronic Scale Co., Revere Corp. of America, Superior Meter Co., and a 50 per cent interest in Hotspot Detector Inc.

Commercial range operations of Magic Chef Inc. are being transferred from Cleveland to the Cribben & Sexton Co. main plant in Chicago. Manufacturing will resume in the near future. Cribben & Sexton, which has bought the

---

Two huge vans containing nearly $50,000 worth of tractor assemblies and components are bringing a complete "factory" service training school directly to J. I. Case Industrial dealers throughout the nation. An experienced staff of Case servicemen accompanying each mobile training unit present three-day courses. One unit is now operating in the Midwest and far west, while the other visits the eastern and southern U. S.

tools, dies, special machinery, patent rights and all inventories of raw materials, work in progress and finished goods of the Magic Chef commercial range operation, will set up its own commercial cooking equipment division.

Westcott & Greis division of American Meter Co. recently celebrated its 50th anniversary. The Tulsa company was founded in 1907 to develop and sell measurement and control equipment for gas and petroleum products in the Southwest.

Minneapolis-Honeywell's industrial division is conducting an automation school on industrial control instruments. The school started in September and will run through the end of 1957. By that time nearly 200 engineers and technicians will be enrolled in classes at the instrumentation education center in Philadelphia. Included are courses in pyrometry, electric potentiometers, pneumatic control and transmission, flow meters, thermometers and pressure gauges.

Mine Safety Appliances de Mexico, S.A. de V.C. has been organized in Mexico City. Arch S. Abbey, Latin American sales manager of Mine Safety Appliances Co,. Pittsburgh, is general manager. Offices, manufacturing facilities, and a warehouse are being established.

Johnson-Williams Inc., Palo Alto, Calif., has completed negotiations with the Heiland division of Minneapolis-Honeywell, Denver, to take over the sales and servicing of the Heiland gas indicator.

A wholly owned financing subsidiary, the J. I. Case Credit Corp., Racine, Wis., has been formed by J. I. Case Co. The new corporation, headed by President John D. Grayson, will handle both dealer floor-plan and retail paper.

Parker Appliance Co., Cleveland, has entered into an agreement to purchase all the stock of Hannifin Corp., Des Plaines, Ill. Purchase price is about $7.5 million of which $5.5 million will be paid in cash and $1.5 in notes, and the balance in Parker common stock. Parker makes many types of flow-control equipment. Hannifin manufactures hydraulic and air power cylinders and presses and miscellaneous components.

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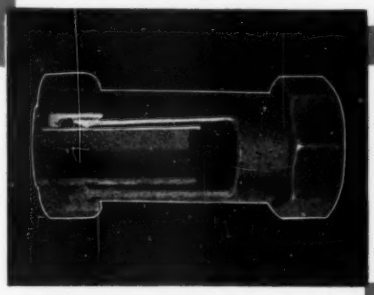
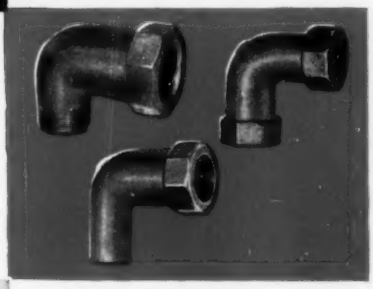
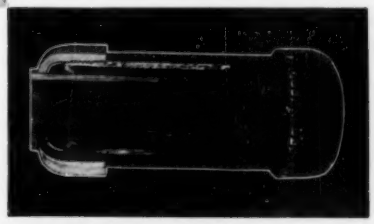


NORMAC COUPLINGS
Normac malleable couplings and sleeves offer the ultimate in deflection and strength with a center wall thickness greater than the wall thickness of the service pipe on which they are used. Every Normac fitting is individually air tested.



COMPRESSION-END "ELLS"
Normac ells of all types incorporate every feature of the Normac coupling plus full coupling depth.

COMPRESSION-END SERVICE "TEE"
Full coupling depth. Special threads on male end prevent dropping into old hand taps.



NORMAC #50-A STEEL COUPLINGS
Manufactured from extra heavy wall pipe. Couplings are available with either seamless or welded centers in sizes from ¾" to 1½" inclusive. 10" and special length centers available.

Normac also manufactures a complete line of red brass fittings in O.D. sizes: ⅝", ⅞", 1⅛", 1⅜"—and a complete line of insulated couplings and fittings.

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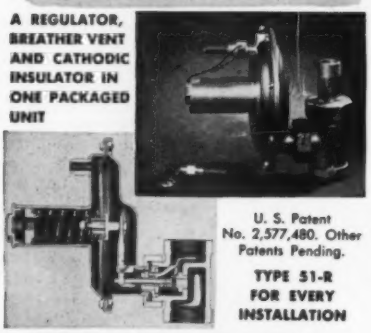

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Exceptionally high relieving capacity obtained by new type internal relief valve. Remarkable by-pass check valve prevents over-shooting of low pressure and damage to meter.

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Anchor's Engineering Dept. will design and supervise plant construction.

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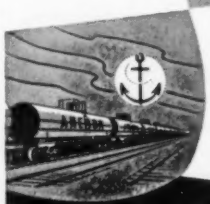
Anchor's experienced staff will assist with the financial details..



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GAS calendar

November

1..AGA-Midwest Gas Association Public Relations Workshop — Nicolet Hotel, Minneapolis.

5- 6..Third Natural Gas Pipeline Institute (sponsored by University of Kansas and Southwest Kansas Petroleum Industry) — Randall's Cafeteria, Liberal, Kan.

6..NEGA Operating Division—Hotel Statler, Hartford, Conn.

11-14..American Petroleum Institute—Conrad Hilton Hotel, Chicago.

13-15..ASA 8th National Conference on Standards and 39th Annual Meeting—San Francisco.

14-16..American Society of Refrigerating Engineers Semi-Annual Meeting—Shoreland Hotel, Chicago.

18-20..SGA Annual Advisory Council & Management Conference—Point Clear, Ala.

18-22..National Warm Air Heating & Air Conditioning Association—Hotel Morrison, Chicago.

December

1- 6..AGA-EEI Electronic Accounting Machine Development Seminar—Sheraton Cadillac Hotel, Detroit.

1- 6..American Society of Mechanical Engineers Annual Meeting—Hotel Statler, New York.

2- 4..Institute of Appliance Manufacturers — Shoreham Hotel, Washington, D. C.

2- 4..Interstate Oil Compact Commission Annual Meeting—Tulsa

4..NEGA Appliance Servicing Conference—Hotel Bancroft, Worcester, Mass.

19-22..Pipeline Contractors Association Annual Meeting BOCA Raton, Fla.

1958

January

6- 8..AGA Home Service Workshop—Hotel Radisson, Minneapolis.

23..NEGA Operating Division—Hotel Statler, Boston.

30..New England Gas Association Accounting Division—Hotel Statler, Boston.

February

20-21..SGA Distribution Management Roundtable Conference—Roosevelt Hotel, New Orleans.

Washington • *Cont'd.*

(*from page* 19)

Right now, legal eagles of the Justice Department and the Federal Trade Commission—as well as those representing Mr. Kayser, no doubt — are trying to chart their strategy in the untapped field of gas pipeline antitrust law.

The Justice Department made the first move last summer by filing an antitrust suit against the El Paso-PacNorWest stock merger under Section 7 of the Clayton Act, which forbids mergers which restrict or tend to restrict competition.

Not long afterward, Mr. Kayser asked the Federal Power Commission for permission to merge the assets of the two firms and combine the two systems. Prior to this, the FPC was without jurisdiction, since only a stock merger had occurred.

Kayser, whose stock ownership of PacNorWest is a soap-like 99 and 80 one-hundredths per cent pure, says combining the two systems would assure "more economical operations and efficient access to gas reserves vitally needed by customers of both companies."

There is no antitrust angle because rates, service, and other factors are and will be controlled by the FPC, he insists. Justice Department says the merger will restrict competition.

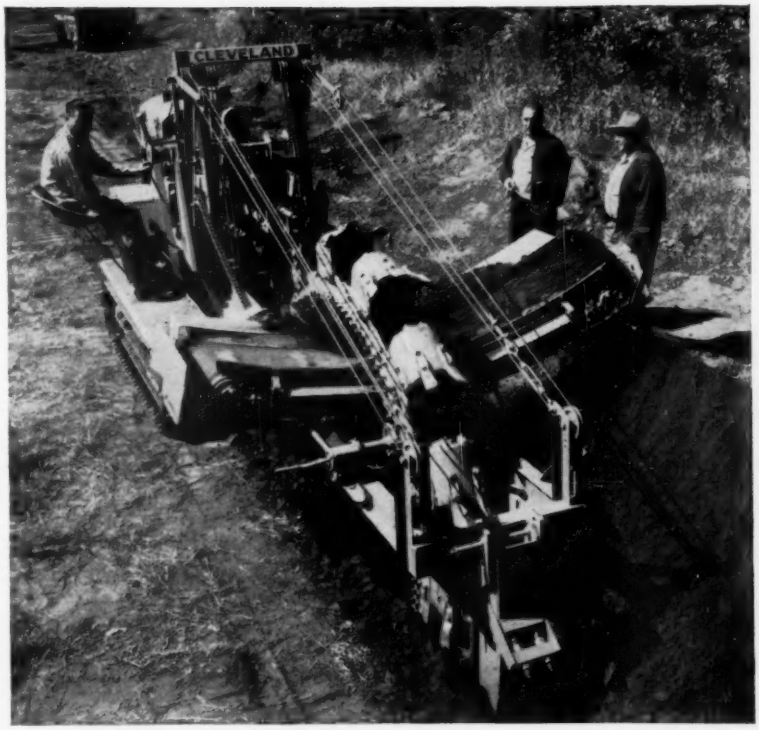
The legal fog arises over a highly complicated legal philosophy the lawyers call "primary jurisdiction."

Justice Department spokesmen say they suspect Mr. Kayser sought permission to merge the two systems to get the case before the FPC, hoping that a go-ahead from the commission would kill off the court cases under the primary jurisdiction principle.

But while it has never been tested in court, the trustbusters say that an FPC certificate permitting the merger would have no bearing on the possibility of a court order forbidding it as a violation of the antitrust laws.

Some government agencies have been empowered by Congress to actually grant an antitrust exemption in approving such com-

digs 'em and fills 'em with Clevelands



This gas company crew is putting a new Cleveland 110 through its paces. Like so many others who know Cleveland's fitness for utility distribution work, this Indiana company has standardized on Clevelands for more than 20 years.

Mains of the same Indiana company are backfilled—and simultaneously compacted—by the one-man-operated Cleveland 80W. It lays pipe, pulls crossings and does other side crane work, too.

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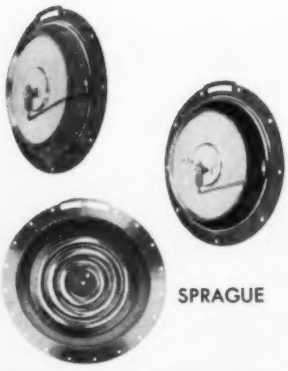
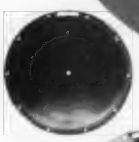
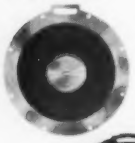


SPRAGUE

Heart of Accuracy



IRONCLAD



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binations, but the FPC is not one of them, they say.

The antitrust aspects of the case can be—but are not required to be—one of the factors the FPC takes into account when deciding a case. Antitrust officials are noncommittal when asked if they will by letter, personal calls, or even by intervening in the case, point out their antitrust contentions to the FPC.

"But you can bet the commission is aware of our antitrust case," one trustbuster emphasizes.

Legal experts expect that one of the cases—either the Kayser petition before the FPC or the Justice Department's complaint before the U. S. District Court at Salt Lake City—will be delayed, so that one case will be settled first.

The government doesn't want to get in the position of simultaneously having one agency say it's all right, and another saying it's against the law, both FPC and the Justice Department admit.

The fact that FPC regulates both companies is one of Mr. Kayser's defensive bulwarks in the antitrust case, and a favorable ruling from FPC would undoubtedly be to his advantage in fighting the court case.

Should FPC approve the merger without considering the antitrust angle, it will in effect be passing the buck to the court. Should it consider the antitrust argument, and rule in favor of Mr. Kayser, the court could still be asked by the Justice Department to overthrow FPC.

It is in this area that the government gets into a political dilemma. The Eisenhower Administration, already facing congressional investigations into charges that regulatory bodies such as the FPC are controlled by the industries they are supposed to regulate, and with the charges during debate on the Harris-O'Hara natural gas bill that the FPC isn't protecting the consumer, would hardly want to find the Justice Department trying to over-rule the FPC on an antitrust matter.

Thus, there is a lot of decisions to be made before the actual antitrust aspects of the merger will be decided. ■

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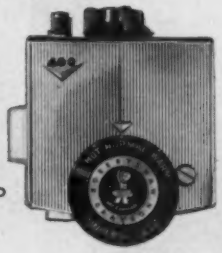

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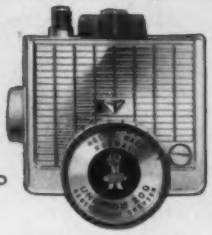

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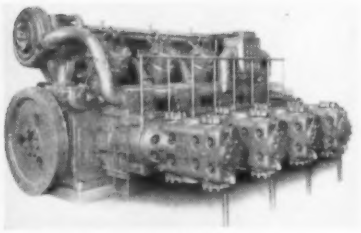
Gas Digest

A digest of what's new in products and trade literature compiled by the editors of GAS as a reader service.

New Products and Trade Literature

For more data on any of these items use the Readers' Service Card on pages 83, 84



1. Compressor kits

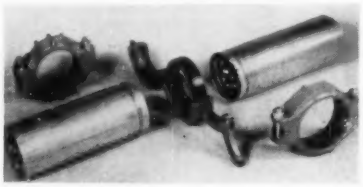
Cooper-Bessemer's field conversion kits substantially increase horsepower ratings of many existing two-cycle engine-driven compressors. Completely integrated engine auxiliaries are now being built for all current V-angle Cooper-Bessemer two-cycle engines. One of the conversion kits provides a "parallel" turbocharging system, the second a "series" turbocharging system.
Cooper-Bessemer Corp.

2. Gravity furnaces

Four new gas-fired gravity furnaces ranging in size from 90,000 to 145,000 Btu input, are announced by American-Standard's air conditioning division. Known as the Model GG, the new gravity furnaces incorporate a single port upshot burner and have a full metal bottom pan for dust-tight enclosure. A minimum of floor space is required. All heated areas have ½-in. thick foil-faced fiberglas insulation.
American-Standard

3. Program controller

Through the use of Bailey's plug-in program controller, industrial process automation is simplified by the receiving, recording and programming of process variables within a single recorder case. A set-point signal for controlling the process variable is produced in accordance with the shape of a 6-in. diameter aluminum cam. This cam is chart-printed and easily field-cut to the desired shape.
Bailey Meter Co.



4. Pipe coupling

A new method of quick coupling thin wall steel and aluminum pipe and tubing is available from the Victaulic Co. Named "Vic-Easy," the new method provides positive, leak-tight connections through the use of quick couplings assembled on Vic-Easy grooved pipe ends. It is available for thin wall pipe and tubing in sizes from 1¼ to 12 in., and may be used for working pressures up to 1000 psi.
Victaulic Co.

5. Flame process

A new jet flame process from Linde makes it possible to pierce rock at speeds up to 10 times faster than conventional drilling methods. The process operates on the rocket principle. Intensely hot, supersonic jets of flame are the key to Jet-Piercing. Traveling five times faster than the speed of sound and reaching temperatures of 4000°F, the flame spits out of a rock-type burner and disintegrates or spalls the rock in its path.
Linde Co.

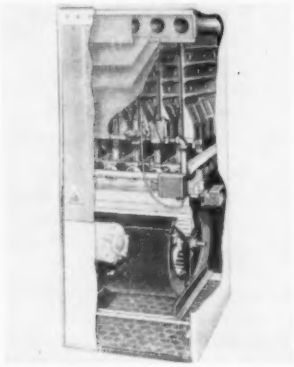
6. Pipe tongs

Tongs which release pipe automatically when weight is slacked off are being marketed by C. A. Mathey Machine Works. For safer handling, the Mathey tongs do not require anyone near the tongs to manually release them. They are available in a complete range of standard pipe sizes from 4 in. to 36 in.
C. A. Mathey Machine Works

7. Oil separator

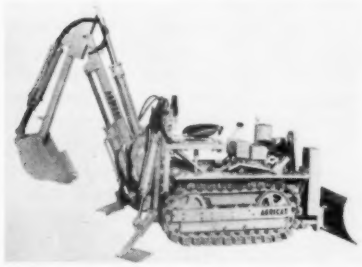
A new oil separator for use in plant streams and in spot checking removes oil from gas streams down to microscopic quantities. According to Manufacturers Engineering & Equipment, the new Model A drains oil immediately out

of the path of the entering gas stream, thus preventing pick-up and build-up of the oil by the gas. The oil is drained down a wick to a reservoir located in the bottom of the separator.
Manufacturers Engineering



8. Gas furnaces

Six sizes of this new gas furnace, ranging from 75,000 to 200,000 Btu, are available from Perfection Industries. Styled along the line of modern appliances, the Perfection "70th Anniversary" line can be built-in or flush-mounted with zero clearance. Air return can be from the bottom, back or either side. Features include Regulaire with three-stage fire and availability of cooling units designed expressly to match the heating systems.
Perfection Industries.



9. Loader

An improved Agricat loader equipped with an ingenious hydraulically operated bucket tilt mechanism has been developed by Joost. Model F long track hydraulic Agricat may be quickly converted from a loader into a light earthmover by replacing the bucket with a blade attachment.
Joost Manufacturing Co.

10. Compression couplings

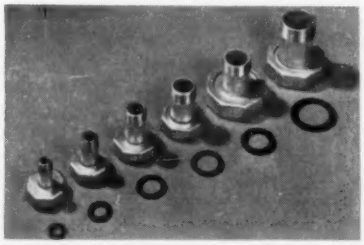
A new line of compression couplings for connecting small pipe for utility and industrial use is available from Joslyn Manufacturing. The new couplings consist of only three components: two compression nuts with integral retaining rings and gaskets, and one steel sleeve. Special construction of steel retaining rings allows the nuts to be screwed up easily on the sleeve and compress the gaskets without friction or seizure.
Joslyn Mfg. & Supply Co.

11. Built-in cooking top

O'Keefe & Merritt has introduced a new look in its built-in cooking tops. Now in full production, this four-burner top has an unusual custom appearance for tile applications. Burner pans fit level with counter top, and small lip on pan allows tile-setter normal leeway in fitting tiles around pan area.
O'Keefe & Merritt

12. Double seal

Teflon is used in a new valve-seating arrangement that achieves a double seal in valves handling petroleum products. According to W-K-M, a specially designed teflon seat insert makes possible the "double-tight seal," which is said to double the sealing efficiency of the valves.
W-K-M Division

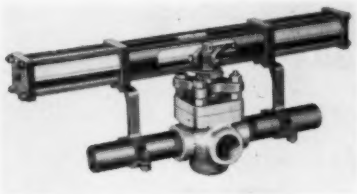


13. Insulating package

Gas meter insulation for use with cathodic protection methods is accomplished by the Universal insulating package. A package for one meter consists of the Universal meter nut, oil and gas resistant gasket, and galvanized malleable swivel. Each swivel has pilot or lip removed, a new feature.
Universal Controls Corp.

14. Water heater

Luxury styling and Diamondglas lining are featured in a new Mission gas water heater. The Mission Diamondglas deluxe offers a recovery rate of 46.2 gal. per hr. The new model has coppertone top and "skirted" base, color-matched controls, and white enamel jacket. The new burner features double row of gas ports for increased high input.
Mission Appliance Corp.

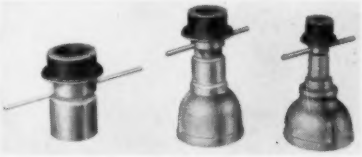


15. Plug valve operators

Designed for use with gas, air, oil, or water at pressures up to 200 psi is a new line of medium duty plug valve operators. Ledeen's new operators are adaptable to a wide range of control requirements, including process cycling, safety and automatic shutoffs, or any combination of these.
Ledeen Manufacturing Co.

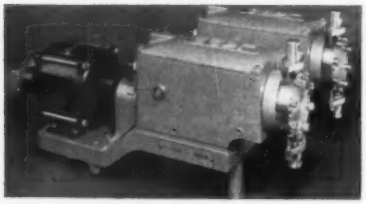
16. Safety switch

Delivery of both primary and secondary air before the automatic gas valve is opened is assured by Hastings' new positive action safety switch. Designed for the Hastings power gas burner, the Positrol air switch operates only if air is actually being delivered.
Hastings Air Control Inc.



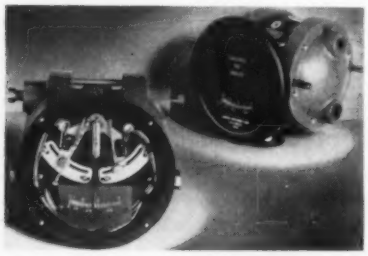
17. Quick connectors

Test time is cut almost two-thirds with Moeller's new line of quick connectors for use with provers when testing gas meters. Available in three sizes—for 2-, 3-, and 4-in. openings—the connectors can be used in a variety of ways, either as single units or in combination.
Moeller Mfg. Co.



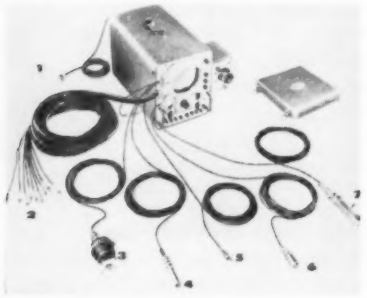
18. Duplex pump

For use in gas company odorizers is Lapp Insulator's new duplex model pump, providing precision pumping, feeding and proportioning of liquids at microflow rates. The Lapp Microflo Pulsafeeder Model LD is designed specifically for pumping two liquids in equal volume or each at a different rate but in exact ratio.
Lapp Insulator Co. Inc.



19. Indicating flow switch

Barton's new indicating flow switch features a rupture-proof bellows unit. Housings available: aluminum, steel, alloy steel, or stainless steel. Model 234 has differential pressure ranges from 0-20 in. w.c. to 0-50 psi with static pressure ratings up to 6000 psi.
Barton Instrument Corp.



20. Engine analyzer

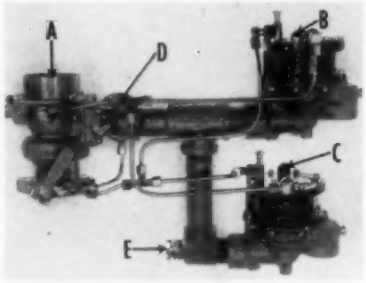
Sperry Gyroscope's portable engine analyzer gives a complete pictorial look at the inner functioning of industrial engines—whether spark-ignited or diesel. The hand-portable multi-purpose equipment enables operators and maintenance men to monitor reciprocating engines and detect and pinpoint malfunctions as they develop. The electronic information is transmitted through wires to the control unit, where it is translated into pictorial patterns on a 5-in. cathode ray screen.
Sperry Gyroscope Co.

21. All-fuel chimney

William Wallace Co.'s new all-fuel, prefabricated chimney is suitable for use with heating appliances, low-heat industrial appliances and domestic incinerators. Listed by Underwriters' Labs for fulfilling new test requirements for factory built-chimneys, the Metalbestos chimney is constructed on the double-wall principle.
William Wallace Co.

22. Home heating package

Holly's counterflow forced air recessed wall heater—with all the automatic and safety features of a central forced air system—offers the advantages of two-speed burner and blower controls. Rated at 65,000 Btu, the new unit will heat most two- and three-bedroom homes without duct work. The big counterflow forced air blower assures even heat distribution.
Holly-General Co.



23. Changeover system

For gas engine installations where the Btu value of the fuel gas varies, Ensign has perfected a new automatic system for changing from low to high and from high to low Btu fuels. The dual-fuel system is suitable for automatically switching from natural to LP gas or vice versa. Installation consists of two fuel regulators, each designed to operate on either high or low Btu fuels.
Ensign Carburetor Co.

24. Selenium rectifier

Especially suited for cathodic protection equipment on pipelines is a new high current density, industrial type selenium rectifier from Radio Receptor Co. Long life, negligible aging characteristics and low voltage drop are attributed to the special vacuum technique in manufacturing and processing. According to the company, field experience indicates the new cells have a life expectancy of 100,000 hours.
Radio Receptor Co.

25. Water separator snubber

Burgess-Manning's water separator snubber, originally designed to provide the dual function of exhaust gas silencing and removing all of the seal water from the exhaust gas of vacuum-sealed pumps, has found a new use. It is being used to remove entrained oil from a water stream. It handles up to 100,000 cu ft per minute and separates up to 1200 gpm of water from the exhaust stream. The water, introduced in the inlet nozzle of the separator, is used to wash all oil out of the air stream.
Burgess-Manning Co.

26. Truck bodies

Auto Body Works' new combination meter-service utility bodies offer a wide variety of compartments. Included are vertical compartments with optional sliding drawers for meters and parts, horizontal compartments with two fixed shelves and removable dividers, open lower compartments, rear vertical compartments with one plain fixed shelf, vertical compartments with deep stationary shelf (radio) above optional sliding drawers.
Auto Body Works

27. Safety gas control

A safety regulator with 100 per cent shutoff in combination with a quiet automatic main gas valve is offered by Thermac. The combination, all-in-one control is designed particularly for forced air furnaces. The safety feature operates independently of the automatic main gas valve.
Thermac Co.

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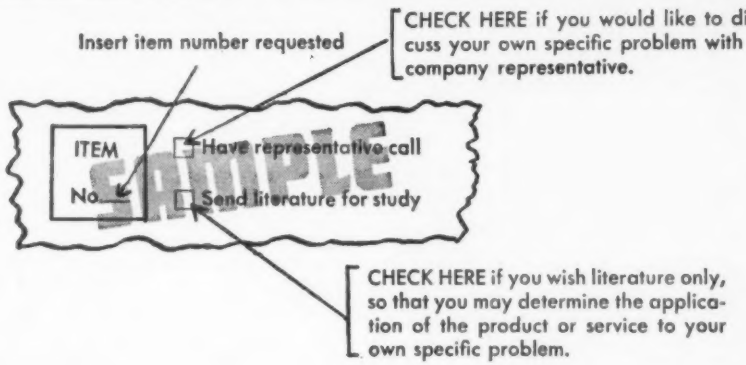
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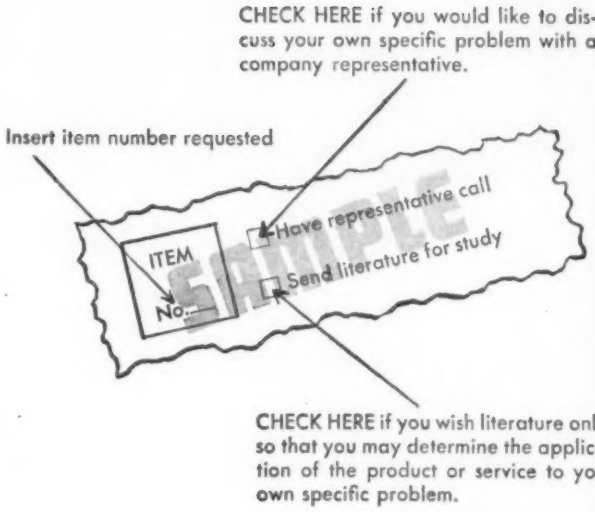
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GAS **magazine**

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LOS ANGELES 57, CALIF.

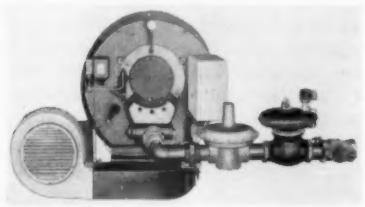
GAS Digest • *Cont'd.*

28. Processing system

A new general-purpose electronic data processing system is in production at ElectroData. Datatron 220 is described as the first medium-priced digital system with full magnetic core memory. The new system combines large-scale computing abilities both for scientific problem-solving—where speed and data manipulation are critical—and business data processing, which requires volume capacity for automatic record handling.
ElectroData Division

29. Concrete pit

A precast concrete pit which can be placed right in the sidewalk has been developed for large gas meters by the Geo. P. Forni Co. The lightweight, non-skid steel cover sets flush with the sidewalk. The meter may be read by merely lifting the small lid in the center of the cover. The pit measures 44 ft wide by 7 ft long.
Geo. P. Forni Co.



30. Gas burner

Iron Fireman's industrial forced draft, flange-mounted gas burner is for use with Scotch Marine or other types of high or low pressure boilers. It can be attached by bolting the burner assembly to the boiler front. It is designed to fire all types of fuel gas with high combustion efficiency and a wide turn down ratio.
Iron Fireman Mfg. Co.

TRADE LITERATURE

31. Muffle furnaces

A new bulletin describes features of Surface standard rated gas-fired muffle furnaces. Included in the illustrated bulletin are field-tested applications for bright heat treatment and brazing of special steels and non-ferrous metals.
Surface Combustion Corp.

32. Analog-to-digital converter

The systems division of Beckman now has available a four-page brochure on the Beckman all transistor analog-to-digital converter. The descriptive bulletin contains complete specifications and uses basic circuit diagrams and sketches to explain operation.
Beckman Instruments Inc.

33. Data processing

"How the Computing System Works for You" is the title of a 36-page guide to the electronic data processing system. Written in non-technical, layman's language, the fast-reading guide is the first in an educational series from the Remington Rand Univac division.
Remington Rand Univac.

34. Rotary air compressor

An eight-page, two-color bulletin (P-106B) describes the new Le Roi rotary air compressor. Thirty-eight photographs are used to illustrate what the manufacturer describes as "the newest with the most."
Le Roi Division.

35. Safety shutoff valve

Partlow's mercury-actuated safety valve which gives positive protection from gas pilot failure is the subject of a new bulletin.
Partlow Corp.

36. Automation

A 79-page manual published by Remington Univac division of Sperry Rand Corp. describes features of the new Univac II data automation system. While retaining most of the basic logical structure and self-checking features of Univac I, the new system has many advanced features.
Remington Rand Univac.

37. Combustion efficiency

F. W. Dwyer is offering a combustion efficiency chart which gives the overall efficiency of a furnace or boiler with one setting. The slide-rule calculator shows visual proof of combustion efficiency, eliminates guesswork and reduces call-backs for the serviceman.
F. W. Dwyer Mfg. Co.

38. Superheat burners

Operating characteristics of Selas Superheat burners are discussed in Bulletin S-1054. According to the bulletin, the burners produce high heat release to localized areas of workpieces, extending the possibilities and increasing the effectiveness of selective open heating.
Selas Corp.

39. Thermostat

Robertshaw's new sensitive, self-contained thermostat for controlling temperature of chicken brooders and other gas appliances is described in a new illustrated bulletin (RT-817).
Robertshaw-Fulton Controls Co.

40. Audio-tone transmission

Design features, operational data, characteristics, and specifications of completely transistorized "plug-in" supervisory control systems developed by Builders-Providence are discussed in a new illustrated, four-page bulletin.
Builders-Providence Inc.

41. Compressor lubricant

Monsanto's new compressor lubricant, Pydraul AC, is the subject of a new bulletin. According to the company, the new lubricant virtually eliminates residues deposited in cylinders and piping of compressed air systems.
Monsanto Chemical Co.

42. Plastic tape

Plastic pressure-sensitive tape for either hand or machine wrapping of pipelines is discussed in a new four-page bulletin from Rubber & Plastics Compound Co.
Rubber & Plastics Compound Co.

43. Plug valves

Functions of lubricants in lubricated plug valves and the essential properties of an effective lubricant are discussed in a 12-page illustrated manual from Walworth.
Walworth Co.

DRAKETOWN

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GAS people

G. J. TANKERSLEY is the newly elected president and a director of Western Kentucky Gas Co., Owensboro, Ky. Mr. Tankersley was formerly executive vice president and a director of the Gas Light Co. of Columbus, Ga. He joined Gas Light in 1949 as an industrial engineer, progressed to chief engineer in 1953, was elected executive vice president in 1954, and a year later was elected a director.

JAMES W. PENNELL, JR. has been named manager of Lone Star Gas Co.'s Ennis (Texas) district of distribution. Mr. Pennell, formerly local manager at Richardson, succeeds J. W. BRANSCOME, who has been named manager of the Sulphur Springs district.

JOHN L. LEISENRING, Chicago district sales engineer for Rockwell Manufacturing Co.'s meter and valve division, has been promoted to assistant manager-gas products sales with headquarters in Pittsburgh.

LEROY E. JIRIKOVEC has been named manager of the Gainesville (Ga.) property of Georgia Gas Co., division of United Cities Gas Co. For the past three years, Mr. Jirikovec has been assistant to P. A. Ray, vice president and chief engineer of United Cities Gas.

Public Service Electric & Gas Co., Newark, N. J., has appointed FRANK FREER, JR. as comptroller, replacing F. WARREN COOPER, who has retired. LEWIS R. FAY succeeds Mr. Freer as assistant comptroller.

CHARLES V. HOEY has been appointed employee relations director of the Peoples Natural Gas Co., Pittsburgh. He was previously personnel director and headed the warehouse-voucher section of the

G. J. Tankersley
Western Kentucky

Charles Stewart
Lancaster

firm's treasury department. The newly created employee relations department has been organized with the aim of expanding personnel services.

JOHN A. BRADY has joined the administrative staff of the Milwaukee (Wis.) Gas Light Co. He will work with Lloyd J. Klein, vice president and controller.

FRANK D. FOLEY, Columbus, Ga. attorney, has been elected president of the Gas Light Co. of Columbus. Mr. Foley, a director of the company, succeeds the late CHARLIE FRANK WILLIAMS.

MERLE MEYERS, who has been Danville, Ky. district superintendent of Western Kentucky Gas Co., has resigned that post to become district manager of the Penn Fuel Gas Co. at Oxford, Pa.

DR. FRANCIS A. SMITH, a chemist in the gas chemistry section of the National Bureau of Standards, retired recently after 32 years of service. He had done extensive work in gas appliance design, gas density measurements, and infrared spectroscopy.

CHARLES W. STEWART has joined Lancaster (Ohio) Meter Parts Co. as assistant to the president. Mr. Stewart, active in the gas meter field for the past 30 years, most recently served as chief engineer of Sprague Meter Co. Mr. Stewart has participated in technical engineering and research work with the PCGA, AGA, and NEGA.

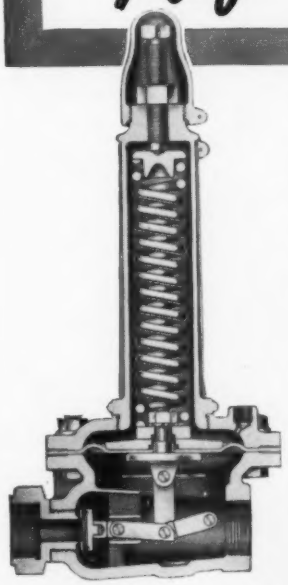
WILLIAM H. FERRISS, for the past four years advertising manager of Temco Inc., has been named advertising manager of Magic Chef Inc., Franklin, Tenn.

L. RAYMOND SAUVE and DOUGLAS M. CHILIBECK are new sales representatives for Canadian Meter Co., Ltd. Mr. Sauve will make his head-

Charles Hoey
Peoples Natural

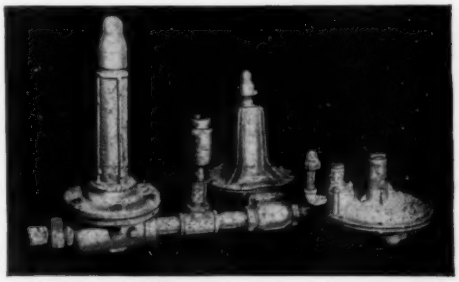
John Leisenring
Rockwell

IN THE HIGH PRESSURE FIELD
THERE IS SAFETY
IN *Reynolds* ...



Accurate, Safe Control

of tremendous pressures is an ever present problem in the gas field. Reynolds field Regulator illustrated at left is one of the many high pressure regulators built by Reynolds. It is thoroughly tested and proved in service. It handles up to 1,000 pounds safely reducing same to pounds. For more than fifty-five years Reynolds has designed and built gas regulators. Safety, accurate performance, years of service—these are some of the built-in factors responsible for Reynolds enviable position in the Gas Control Field.



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people • *Continued*

quarters in Montreal, and Mr. Chilibeck will work out of Edmonton.

WILBUR W. LINTS has been named sales service representative of American Meter Co. with headquarters in Erie, Pa. Mr. Lints has 18 years' experience at the American Meter Albany factory. The company also has named VERNON C. WELSH to the post of sales representative for the Wynnewood, Pa. sales district. Mr. Welsh is a 20-year veteran with the company.

W. T. HALKET has been appointed to the newly created post of marketing director of A. O. Smith Corp.'s Permaglas division in Kankakee, Ill. J. W. BURLESON becomes general sales manager of the division. Mr. Halket was formerly general sales manager of domestic water heaters and Mr. Burleson was general sales manager of heating and air conditioning equipment.

VICTOR L. BERGER has been named regional sales representative for Empire Stove Co., Belleville, Ill., in the Oklahoma and southern Kansas areas.

WALLACE ETHERTON has been named supervisor of Holly-General Co.'s expanded quality control department. He will control this new department at both the Pasadena and Burbank, Calif. plants.

JOSEPH E. BRUNK, project engineer at Tappan Stove Co., Mansfield, Ohio, has been promoted to chief engineer for the Canadian Tappan Stove Ltd. and Gurney Products Ltd. in Canada.

JAMES A. SCANLON, a vice president of Columbia Gas System Service Corp., New York, has been elected to the board of directors. He has also assumed the duties of

Wilbur Lints
American Meter

Vernon Welsh
American Meter

vice president-rates following the retirement of E. R. CONNER.

C. H. KOCH, United Petroleum Gas Co.'s sales representative in Indiana, has assumed duties of sales representative in the Illinois area. He replaces WALLY STANGE.

ROBERT W. CARVELL has joined the sales staff of Henry Valve Co., Melrose Park, Ill., as sales supervisor of the new industrial division.

ELMER GATES has been appointed manager of the rate department of Middle West Service Co., Chicago.

THEODORE S. PETERSON is the newly named sales manager for the Quick-Way Truck Shovel Co., Denver. He succeeds DANIEL S. HEFFRON, who resigned recently.

CARL A. LINDE has been promoted to the newly created post of staff planning engineer for Washington Natural Gas Co., Seattle. DAVE M. BARRETT, who has been industrial sales manager, becomes industrial and commercial sales manager, and LEONARD VOELKER is northern division commercial sales supervisor.

ARTHUR R. MARSHALL has been appointed engineering supervisor in the Boston district of the ElectroData division of Burroughs Corp.

D. M. SIMMONS, one of the real pioneers in the oil and gas development of northwest Louisiana and with more than 36 years with United Gas and predecessor companies, retired recently. Since 1948 he has been assistant general superintendent of drilling and production.

WILLIAM F. KAMSLER has assumed the post of product line sales supervisor, systems division

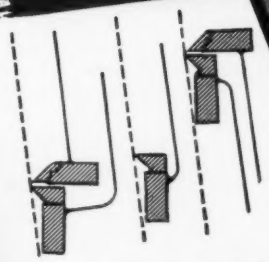
W. T. Halket
A. O. Smith

James Scanlon
Columbia Gas

ARCCO

BETA CHART PENS

...HOLD 2 to 4 TIMES MORE INK



Beta Fountain Pens hold two to four times the ink of ordinary chart inking pens. Regardless of the line thickness Beta Pens produce a smooth unbroken and uniform line. Pens shown are approximately actual size and can be arranged to reduce time interval between static and differential lines to only a few minutes. Beta Pens are especially suitable for seven day records. Price $1.20 (lower prices in quantities).

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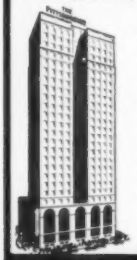

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people • *Continued*

of Beckman Instruments Inc., Anaheim, Calif. He will be responsible for sales of low speed data processing systems.

Southern Counties Gas Co., Los Angeles, has promoted three executives following the retirement of GEORGE W. SMITH as Santa Barbara division manager. THOMAS N. BANKS, with SoCounties more than 20 years, succeeds Mr. Smith. MONTE S. CHRISTIE succeeds Banks as superintendent of the San Gabriel valley division; and FRED B. BENNETT, distribution supervisor at San Gabriel, succeeds Christie as superintendent in the Santa Barbara division. Mr. Smith spent 31 of his 38 years with SoCounties as manager in Santa Barbara.

Thomas Banks
SoCounties

Fred Bennett
SoCounties

Monte Christie
SoCounties

George Smith
SoCounties

EARL KIRMSER has been named director of public relations of Rheem Manufacturing Co., New York.

JOHN R. KLEESPIES has been appointed manager of the department on procedures and organization, a newly created position with Pacific Gas & Electric Co., San Francisco.

W. E. NELLIST has replaced EUGENE F. ANDERSON as news and editorial service manager for Wheelabrator Corp., Mishawaka, Ind.

WILLIAM T. BRENT has been appointed sales promotion manager of Temco Inc., Nashville.

GILBERT D. DOROFF has been promoted to national sales manager of Bendix mobile products and FRANK R. VIAFORA replaces him as Midwest regional manager for Bendix two-way mobile products.

CLAIR H. LEWIS, senior engineer with Columbia Gas System, retired recently after 40 years of service with the organization. He began his career in the gas business as an inspector with the Ohio Fuel Supply Co., which later became Ohio Fuel Gas Co. For the last 20 years he has been senior engineer with the service organization in its Columbus, Ohio, office.

CLYDE D. ALSTADT, supervisory engineer in the gas engineering department of the Columbia Gas System Service Corp., Columbus, Ohio, has retired. He has been with the system since 1917, when he joined the Ohio Fuel Gas Co. predecessor.

HELEN F. LYONS has joined Smith-Blair, South San Francisco, to head up the company's new advertising and public relations department.

Deaths

PAUL HOWARD, district manager of Georgia Gas Co. for 15 years in Gainesville, Ga. died recently. He was 45. He also managed Carolina Central Gas Co., Hendersonville, N. C.; and South Carolina Gas Co., Gaffney, S. C., all subsidiaries of United Cities Utilities Co. of Chicago.

MARION L. FORT, senior vice president of Pacific Lighting Gas Supply Co., died in Fullerton, Calif. recently. He was 53. Mr. Fort started with the company in 1923 as a laborer. In 1936 he was made general superintendent and in 1940 became superintendent of the company's compressor plants. In 1950 he was elected a director and in 1951 was named general manager.

VARS W. BATES, gas transmission superintendent for Southern Union Gas Co.'s mainline department, died recently in Farmington, N. M. Mr. Bates joined the company in 1937 and worked his way up to one of the top positions.

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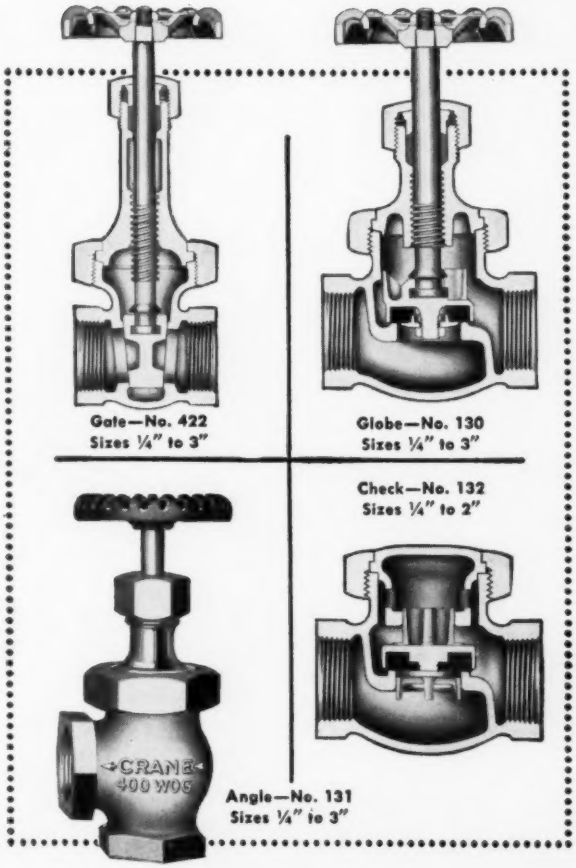

You can be sure of *safer* installations on storage tanks, piping, tank trucks and customers' premises when you use Crane Bronze LP-Gas Valves.

Crane Bronze Valves are built to stay tight even under severest service conditions. Globe, angle and check patterns are fitted with Crane No. 6 long-wearing composition discs, which are *cemented* into place for double insurance against internal leakage. Gate patterns have a fully guided wedge disc; it seats tight, resists seating surface wear.

Standardize on Crane Bronze Valves. Your installations will be safer—your customers more confident. These U/L approved valves are available at your local Crane outlet.

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GAS

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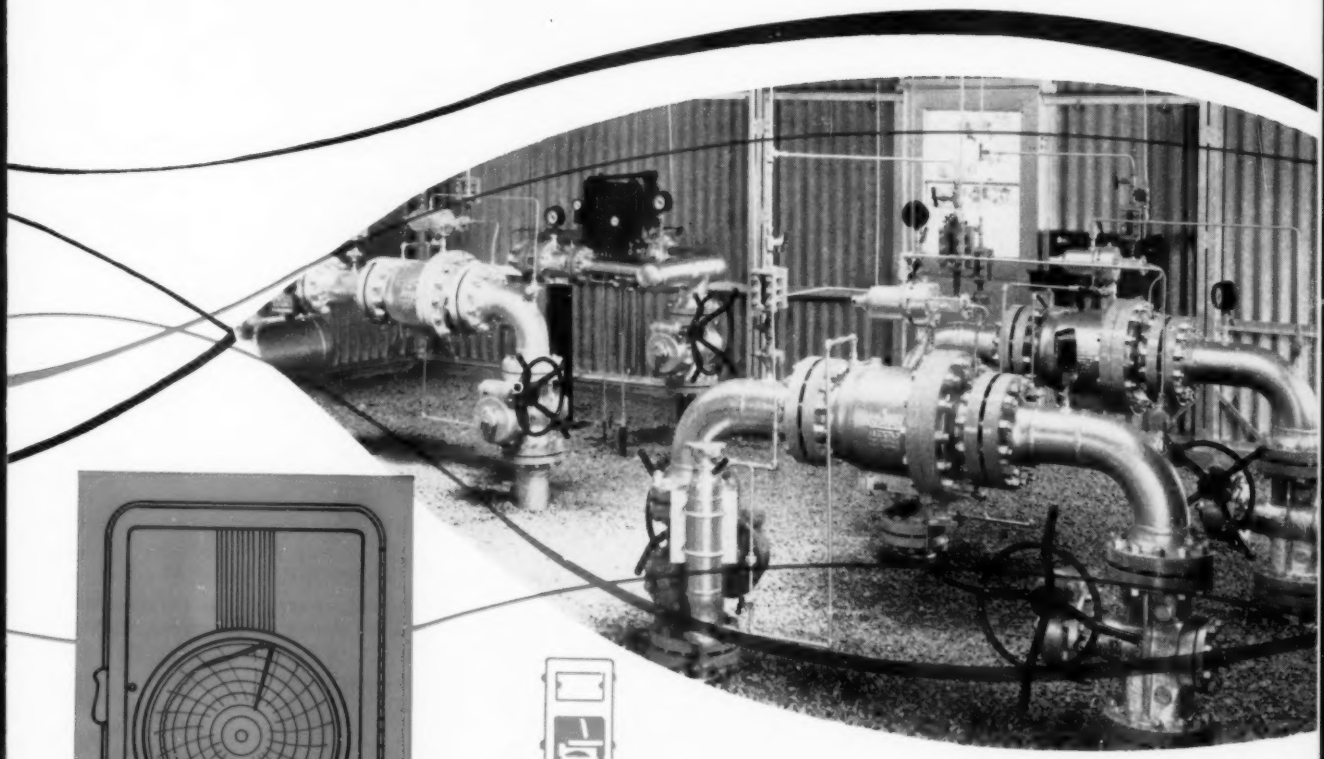

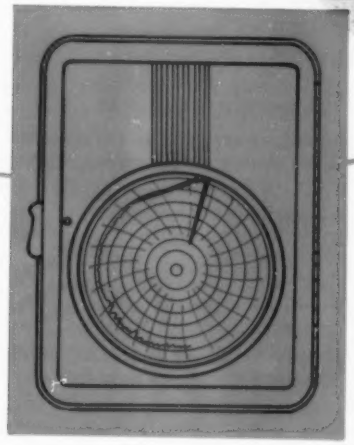

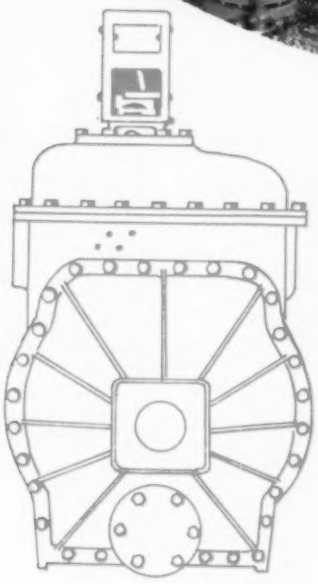

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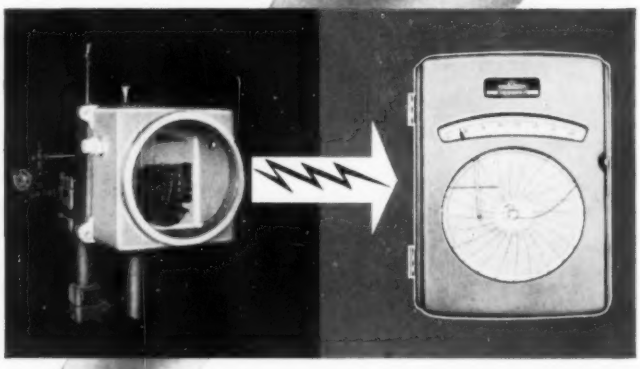

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By FRANK M. PARTRIDGE,
Measurement Superintendent
Pacific Northwest Pipeline Corp.,
Salt Lake City

Measurement operations at Pacific Northwest

THIS is the story of the planning, development and growth of a gas measurement department in one of the major gas transmission systems, that of the Pacific Northwest Pipeline Corp. Gas to supply this system is produced from fields in New Mexico, Colorado, Utah and Wyoming. Gas purchases are based on measurement at the wellhead in most cases. Starting this fall, large volumes of gas will be obtained from Westcoast Transmission Co. Ltd. at the International Boundary near Sumas, Wash. Generally, all of the purchase and sales meters are owned and operated by Pacific Northwest.

Fig. 1 shows the Pacific Northwest system. Locations of sales meter stations and check meter stations are shown. The production and purchase meters are rather closely spaced in the various gas fields. At the present time the number of meters in service are:

Sales, orifice	58
Sales, displacement	24
Purchase	190
Production	185
Check	8
Company use	29
TOTAL	494

Production meters are those measuring gas from a well in which Pacific Northwest participates in the ownership. Purchase meters include wellhead meters at wells in which Pacific Northwest does not participate in the ownership.

Actual construction of the Pacific Northwest Pipeline system was started in June, 1955. The first utility customer sale was to the Utah Gas Service Co. at Monticello, Utah, on Aug. 10, 1956. The first direct industrial sale was on Aug. 11, 1956, to the Westvaco Mineral Products division of the Food Machinery and Chemical Corp., which is located about five miles west of Pocatello, Idaho.

Because of the importance of accurate measurement of gas purchased and sold, it is essential that proper attention and personnel be devoted to this function. Inaccurate measurement would be unfair either to the buyer or the seller. The pipeline company cannot be successful unless its customers are successful. The success of a gas pipeline company or utility company is based upon accurate and economical gas measurement.

It is the purpose of the gas measurement department to select equipment and to design and operate measurement stations in as accurate a manner as can be economically justified. All expenditures are carefully considered to determine if they can be justified by the anticipated results.

The gas measurement department is responsible for obtaining measurement results that are satisfactory to all concerned. This responsibility must be balanced by

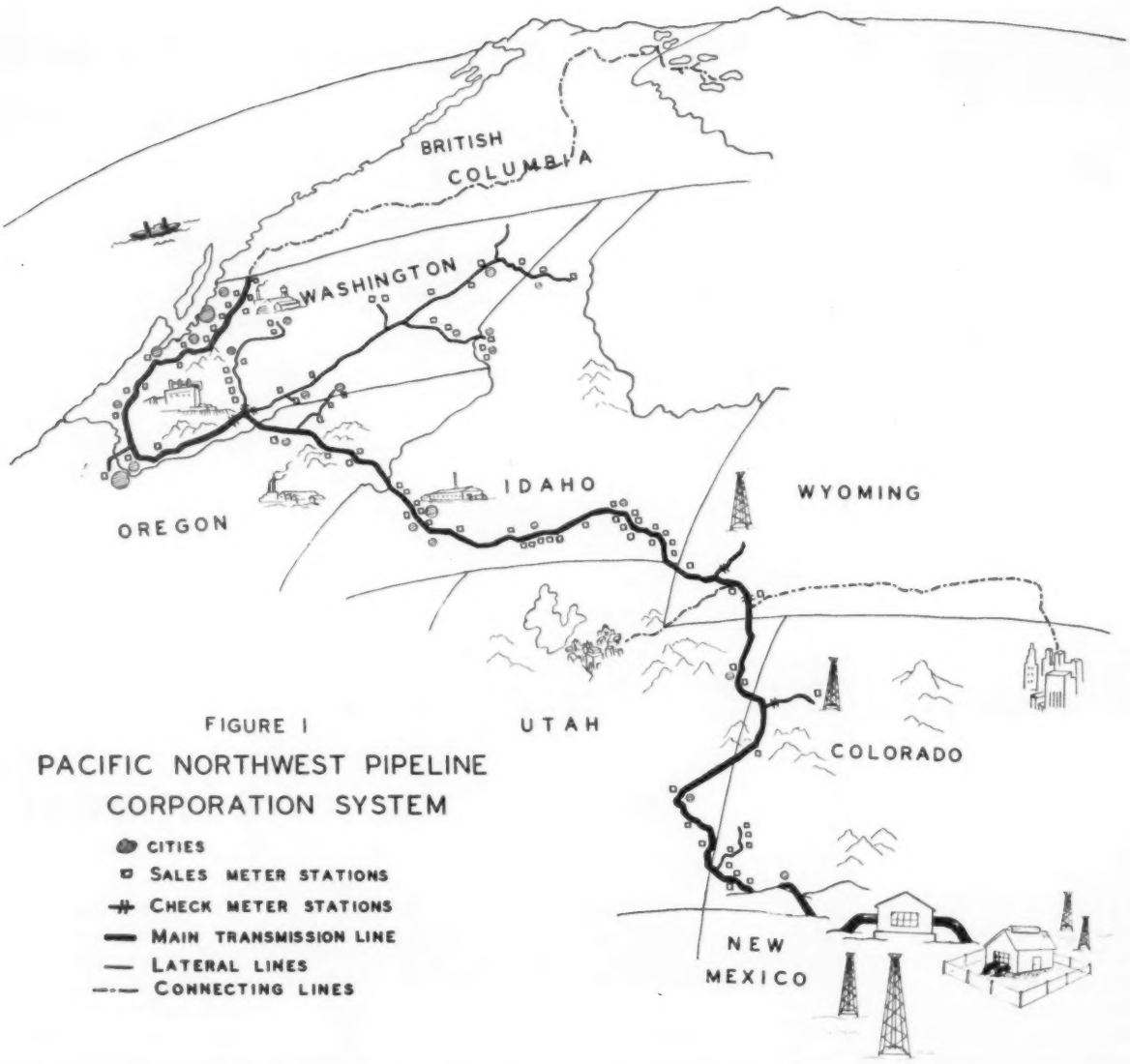


FIGURE 1

PACIFIC NORTHWEST PIPELINE CORPORATION SYSTEM

authority. The person responsible for measurement results must also have the authority to see that metering equipment is properly installed and operated.

The Pacific Northwest gas measurement department is one of several functional departments. At the time the project was started, an organization chart was prepared showing the number of people that would be required to operate the department. The various positions in this organization were filled as the need arose. The organization will be expanded as growth justifies. The system is divided into geographical divisions. The measurement functions of each division are under the direction of a field measurement supervisor. He has the authority and responsibility for all measurement operations in his division.

Each division is further divided into districts, which are generally operated and maintained by a meter inspector. The number of meters in each district varies widely depending on the spacing and types of meter. In the Big Piney gas field, one man looks after about 50 wellhead purchase meters which are in a rather compact group. Ordinarily, along the mainline where sales meter stations are widely spaced, a man is assigned from 8 to 12 sales meters. These may be spread through a distance of more than 200 miles.

A measurement engineer is assigned to the Salt Lake Office. He has the responsibility of checking the condition and operation of all meter stations. He is also responsible for the construction of new meter stations. The measurement engineer is directly responsible to the superintendent of measurement and acts as the superintendent's representative in contacting the field personnel. An instrument technician assists the measurement engineer. This man has the responsibility of setting up procedures for the maintenance of the more complex instruments, such as heating value, specific gravity and dew point recorders, as well as control instruments in the compressor sta-

tions. The instrument technician is available for consultation to work out any problems in the instrumentation field.

The office procedures for calculating gas volumes through orifice and displacement meters are carried out in Salt Lake City under the direction of the office measurement supervisor. At the present time, his staff consists of a chief chart clerk, three senior clerks and three integrator clerks.

Pacific Northwest's gas measurement department is responsible for the installation and operation of displacement meters, orifice meters, pressure regulators, and such specialized equipment as recording calorimeters, gravitometers and dew point instruments.

Standard meter stations (*see Fig. 3*) are used in gas measurement operations throughout the Pacific Northwest system. *Fig. 4* shows a typical sales meter station. The building cover consists of corrugated asbestos cement or metal with two transluscent panels in the roof. There are windows on each side and in the door to provide good lighting. A large vent along the full length of the roof ridge provides good ventilation and a safe exhaust for any gas leakage in the building.

The various classes of stations are similar and vary only in size and number of meters and regulators. *Fig. 3* shows that station design is very flexible in that station capacities can be varied by changing the meter and regulator port size. All Class II stations are identical except for the meter and regulator port size. If it should become necessary to increase the station capacity, a Class II-B station can be changed to a Class II-C by changing the meter. The largest size in any major classification is never installed initially as there would then be no provision for increasing the capacity if required.

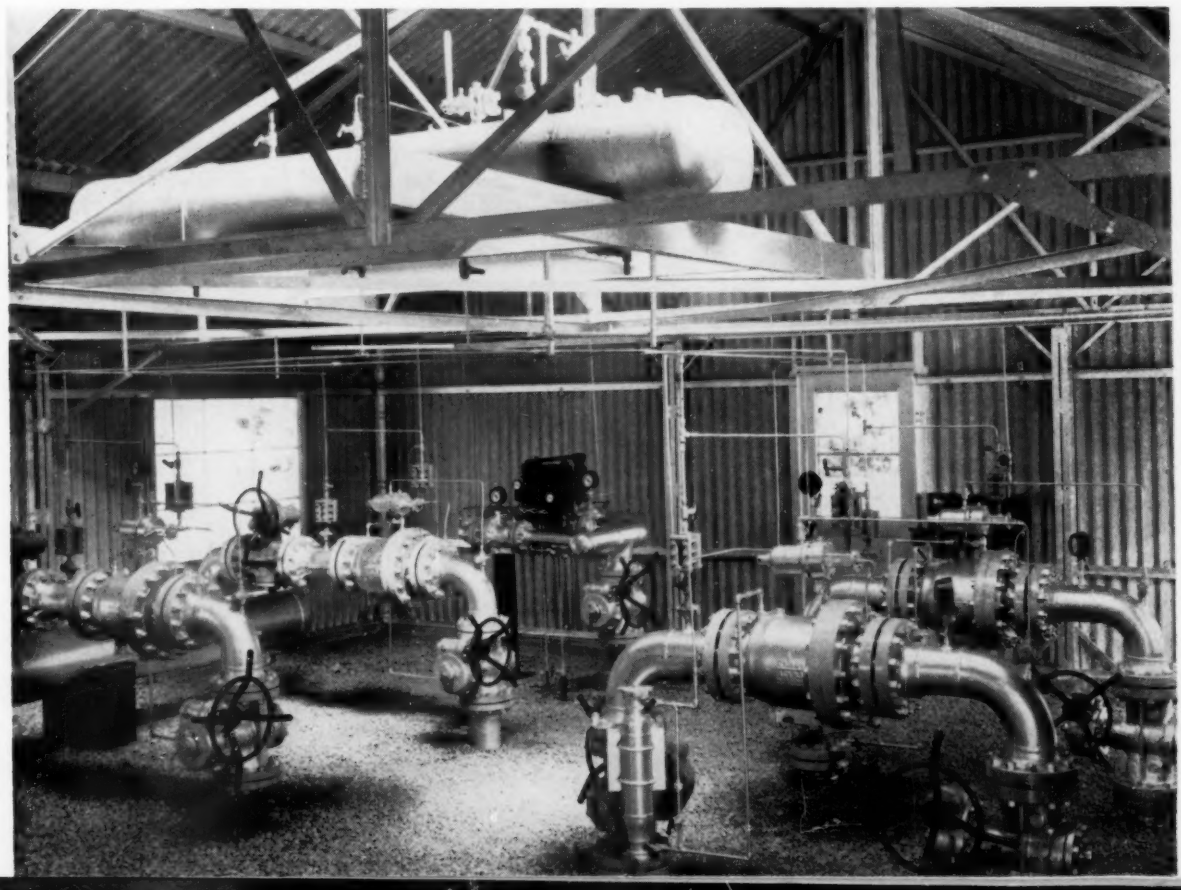
To insure the highest accuracy in measurement, all orifice meters for sales meter stations were sized using a beta ratio of 0.60, and 50-in. range orifice meter gauges. All large sales meter stations make use of senior orifice fittings for convenience in inspecting orifice plates without interrupting the gas flow or operating bypass valves. Square-root orifice meter charts are used on all orifice meters throughout the system.

For safety, monitor or standby regulation is provided even though one stage is all that the AGA code requires. In addition a relief valve is provided to prevent overpressuring the downstream piping in the event that both of the regulators should fail in the open position.

One of the problems on this project is the prevention of freezing in the pressure regulators. At several locations in the system, recorders have been installed to provide a continuous record of specific gravity, heat content, and dew point of the gas. The record of the gas dew point provides a warning when measures are required to prevent regulator freezing.

A view of the interior of a typical sales meter station is shown in *Fig. 5*. The gas enters through the valve at the lower right and passes through the parallel standby or monitor regulators shown in the foreground. It next goes underground and then in the opposite direction, through the two meter

Fig. 2. View of class IV regulators, relief valve and alcohol storage tank at measurement station.



CLASS	METER	REGULATORS	REGULATOR PORTS	MEASUREMENT PRESS. APPR.	BLDG. SIZE	MCF CAPACITY PK. HR.	MCF CAPACITY PER DAY
I-A	80B Metric	2-1" Reliance "P"	9/16", ¼ area	150#	10' X 16'	15	255
I-B	250B Metric	2-1" Reliance "P"	9/16", ¼ area	150#	10' X 16'	37	630
I-C	500B Metric	2-1" Reliance "P"	3/4", ½ area	150#	10' X 16'	62	1,050
I-D	2-500B Metc.	2-1" Reliance "P"	1 1/16", Full area	150#	10' X 16'	124	2,100
I-E	1-3"Orifice	2-1" Reliance "P"	1 1/16", Full area	150#	10' X 16'	120	2,000
I-F	25B Metric	2-1" Fisher No. 630	1/8"	150#	8' X 8'	5.6	95
II-A	3" Orifice	2-2" Reliance "P"	3/4", ¼ area	400#	16' X 22'	143	2,430
II-B	4" Orifice	2-2" Reliance "P"	1 1/16", ½ area	400#	16' X 22'	245	4,160
II-C	6" Orifice	2-2" Reliance "P"	1 7/16", Full area	400#	16' X 22'	530	9,000
III-A	6" Orifice	2-4" Grove	Not Applicable	400#	18' X 30'	530	9,000
III-B	8" Orifice	2-4" Grove	Not Applicable	400#	18' X 30'	980	16,700
III-C	10" Orifice	2-4" Grove	Not Applicable	400#	18' X 30'	1,500	25,500
IV-A	2-8" OM	4-4" Grove	Not Applicable	400#	30' X 36'	1,960	33,400
IV-B	2-10" OM	4-6" Grove	Not Applicable	400#	30' X 36'	2,950	50,000
IV-C	2-12" OM	4-8" Grove	Not Applicable	400#	30' X 36'	4,042	68,676
	SPECIAL AS REQUIRED						

Fig. 3. Meter station data.

runs in the background, into the header shown in the right-center background of the picture. One of the two parallel operating regulators can be seen in the right-center portion of *Fig. 5*. An alcohol storage tank for the station can be seen above the lower chord bracing of the roof trusses. The station floor is of crushed rock which presents a neat appearance and allows any condensation dripping from the pipes to drain away without becoming an unsightly problem in the station.

Fig. 6 is a view of the second set of operating regulators which reduce the pipeline pressure to the normal delivery pressure of 150 psig. The alcohol feed lines and gas dryers for the pilot gas show clearly in this view. The relief valve assembly is in the right foreground. This consists of a back pressure regulator in parallel with a plug valve equipped with a power operator. The back pressure regulator handles small or temporary excess pressures due to slow regulator closing or regulator leakage. In case of complete regulator failure, the plug valve is opened automatically by the power operator to relieve the excess pressure. It is very unusual for the relief valve assembly to open because any excess pressure causes the monitor regulators to go into operation and control the pressure.

A great deal of consideration was given to measures that could be taken to avoid freezing in the gas stream near pressure regulators. *Fig. 7* is a view showing the operating pressure regulators. Alcohol is dripped into the gas stream through the sight glass (shown just upstream of the pressure regulator) and into the pilot gas line just ahead of the pilot regulator.

The main regulators are not as likely to freeze as are the pilot

Fig. 4. Typical sales meter station on PNW line.

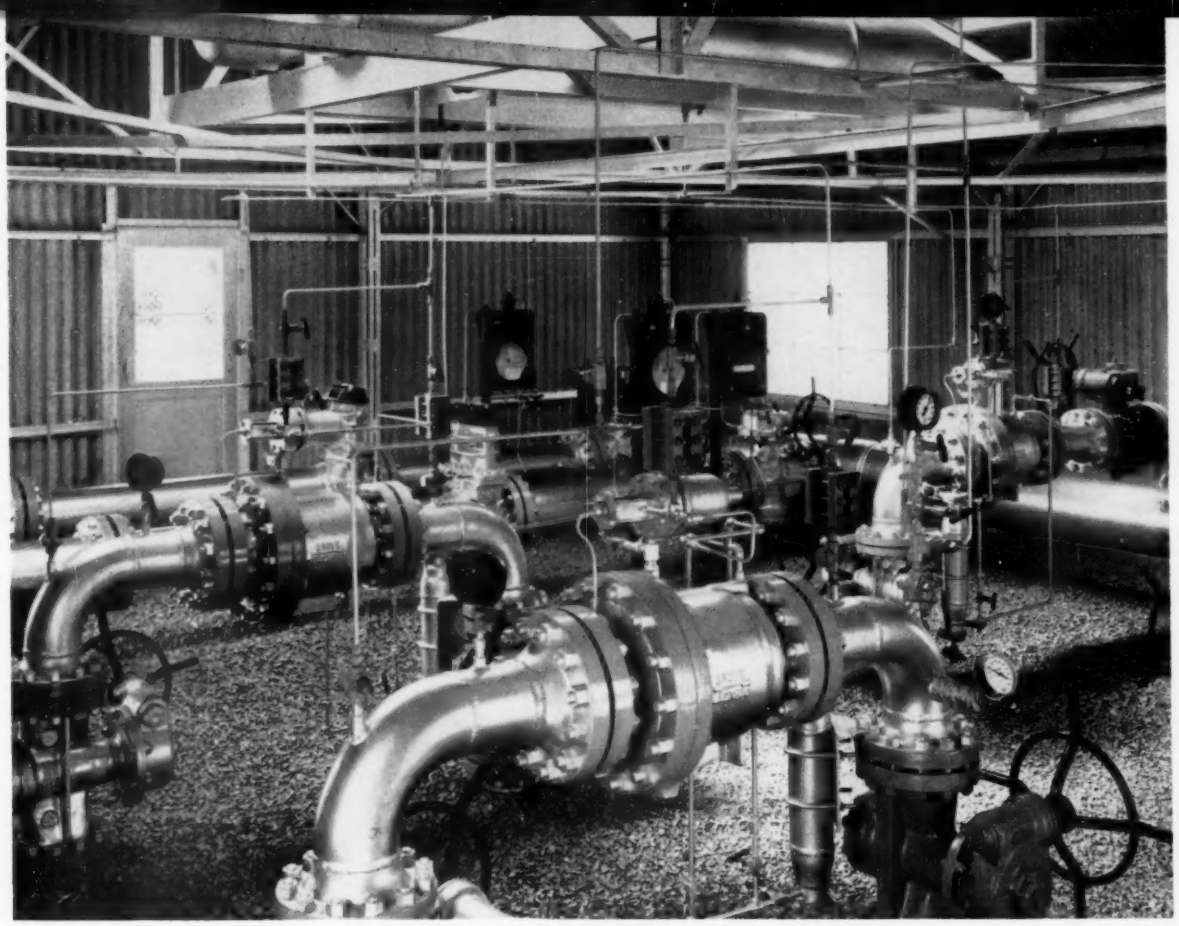


Fig. 5. Interior of PNW sales meter station.

regulators. The pilot gas passes through the gas dryer shown in the lower left corner of *Fig. 7*. Provision is made to drip alcohol into this pilot gas stream as required when operating conditions warrant. The dripper for this purpose is immediately to the left of the pilot regulator.

In the background can be seen a power operator on the downstream plug valve of the secondary meter run. This valve is actuated as required by the differential limit tripover controller, which can be seen just to the right of the nearest orifice meter recorder.

Consideration was given to applying heat to the gas upstream of the regulators. Because it is anticipated that in the near future the gas will be relatively dry, it was felt that the application of heat would not be required. When the dew point is high enough so that the probability of freezing is indicated, meter inspectors are dispatched to turn on the alcohol drippers as required.

All regulators on sales meter stations are of the single seat type because the flow through these regulators is streamlined and less turbulent. This makes them less susceptible to the formation of gas hydrates or ice crystals in the regulator body.

Based on approximately one year's experience at the meter stations which were designed in accordance with the principles set forth, the operation has been found to be very satisfactory. The meter stations are relatively simple but include many safety factors to insure continuity of service. As had been expected, considerable difficulty was experienced with freezing problems in the regulators. The regulators and downstream piping are often heavily coated with frost during cold weather operation. It was found that the injection of methyl alcohol in the gas stream ahead of the regulators was very effective. On numerous occasions the meter inspectors have reported visiting a station where the regulators were starting to freeze. A few drops of methyl alcohol upstream of the regulator or pilot promptly corrected the impending difficulty. Fortunately, freezing in the regulators usually occurs as a gradual process. The first noticeable effect is an unusual variation in the gas flow. This is indicated most quickly by the differential on the orifice meter.

While very good results from alcohol injections can be obtained by dripping the alcohol right on or immediately upstream of the regulator seats, even more effective results are obtained if the alcohol is injected further upstream so that sufficient time is allowed for it to be completely vaporized before the pressure reduction takes place.

The sales meter stations were designed to have two stages of regulation, one upstream and one downstream of the meter. At first,

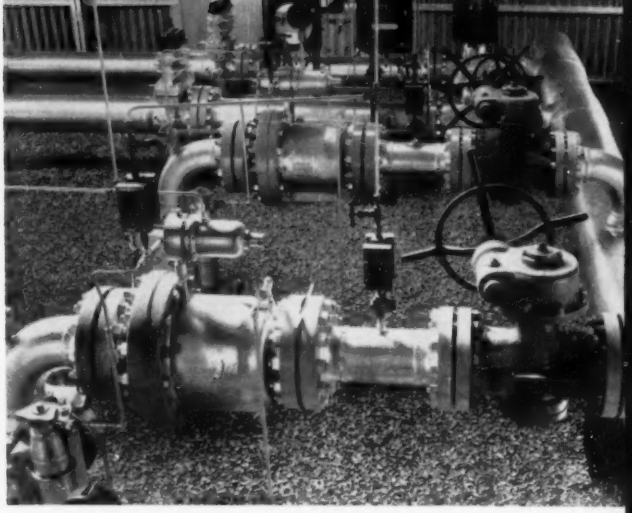


Fig. 6. (left) Operating regulators and relief valve assembly. Fig. 7. (right) Operating regulators and orifice meters.

the pressure cut was taken in two stages with the idea that this would tend to minimize difficulties resulting from hydrate formation. However, it was found that there was little to be gained by taking the pressure cut in two stages and we are now using the second stage regulator to take the full pressure reduction and using the first stage regulator as a standby or monitor. This has another added advantage in that the gas through the orifice meter has not been cooled as a result of pressure reduction.

Some problems have been encountered because of the very small gas deliveries to towns when they were first turned on. The pressure regulating equipment selected for this system has performed in a very satisfactory manner even though the initial loads were only a very small percentage of their capacity. The most serious difficulty in measuring these small loads has been caused by the volumes being below the minimum capacity of the orifice meters. This has required the installation, in a great many cases, of minimum size orifice plates. When the resulting differential on the meter has been too low for good measurement practice, it has been possible to increase it in all cases by reducing the static pressure on the meter. All of the orifice meter charts are of the square-root type and every effort is made to keep the differential records above three on the chart.

The meter inspectors are equipped with all necessary tools and instruments needed to adequately take care of their responsibilities in operating and maintaining meter stations. At the present time they are furnished station wagons for transportation. These have sufficient room for the equipment and are satisfactory for the large amount of driving required in their various assignments. Station wagons are equipped with two-way radios so that measurement personnel can communicate with the base station at division headquarters, compressor stations, other automotive equipment and the company airplanes.

Close liaison is maintained with the other departments of the company. The pipeline department and the compressor station department work closely with the measurement department in providing uninterrupted service to our customers. Each department stands ready to assist any of the others when the need arises.

All gas measurement is based on the recommendation and data contained in Gas Measurement Committee Report No. 3 of the American Gas Association. Pacific Northwest has adopted a standard pressure base of 14.73 psia for use where another pressure base is not required by state regulatory bodies. The Federal Power Commission has adopted 14.73 psia as a standard for all of its work. The American Gas Association's orifice meter tables are all on a basis of 14.73 psia. This pressure base is practically the same as the 30-in. of mercury that is almost universally specified for such gas testing purposes as the determination of the heating value of the gas. There appears to be a trend in the industry toward adopting the standard pressure base of 14.73 psia which seems to have more advantages than any of the others now in use. In some cases, state regulations and gas contracts make it difficult to adopt the new pressure base.

Fig. 8 shows the back printing on the Pacific Northwest's orifice meter charts. The information posted on this chart in the field and in the office is shown in the designated blocks printed on the chart. All pertinent information required for each meter is preprinted on the chart by means of an addressograph as shown in the lower center section. If the preprinted charts are not available, the same information must be manually posted in the large square in the lower left-hand portion of the chart. The charts are changed in most cases by contract chart changers. This leaves meter inspectors free to plan and carry out their various functions as required. The chart changer need only show the exact time "on" and "off" on the chart, and his signature.

In the office, the temperature and pressure are posted on the

back of the chart after having been determined from the chart record. All of our orifice meter gauges have built-in temperature elements so that the temperature record is on the orifice meter chart. The temperature is usually recorded in green ink and this provides a good contrast with the black chart printing, the red differential record and the blue static record. These three pen recorders have worked out very satisfactorily and have considerably simplified our chart handling procedure.

The gravity, Btu, per cent nitrogen, and per cent carbon dioxide are obtained from other sources and posted on the chart in the space shown. The integrator "stop" and "start" readings are posted in the space provided. The chart is then ready to be transmitted to the machine accounting section. All calculations including the determination of the integrator differences are determined by means of electronic computing machines. The gas measurement department furnishes to the machine accounting department a coefficient which includes a basic coefficient, the Reynolds' number factor, the pressure base factor and the manometer factor. The flowing temperature factor, the specific gravity factor and the supercompressibility factor are determined by and applied to the volumes on each chart by the electronic computer. The volumes from these data are computed in terms of cubic feet at 14.73 psia, and also at another pressure base if it is so stated in the contract. The volume is also computed in terms of therms as almost all of the sales agreements specify this unit of sale.

The results from the machine accounting section are posted on the back of the chart in the space provided. The volume information is also stored on punch cards in the machine accounting section where the information is available for various statistical purposes. These cards are also used in the preparation of volume statements at the end of each month. It is, therefore, not necessary for the gas measurement department to maintain ledger or volume information in other forms as needed data can always be obtained from the machine accounting section in the form required. ■

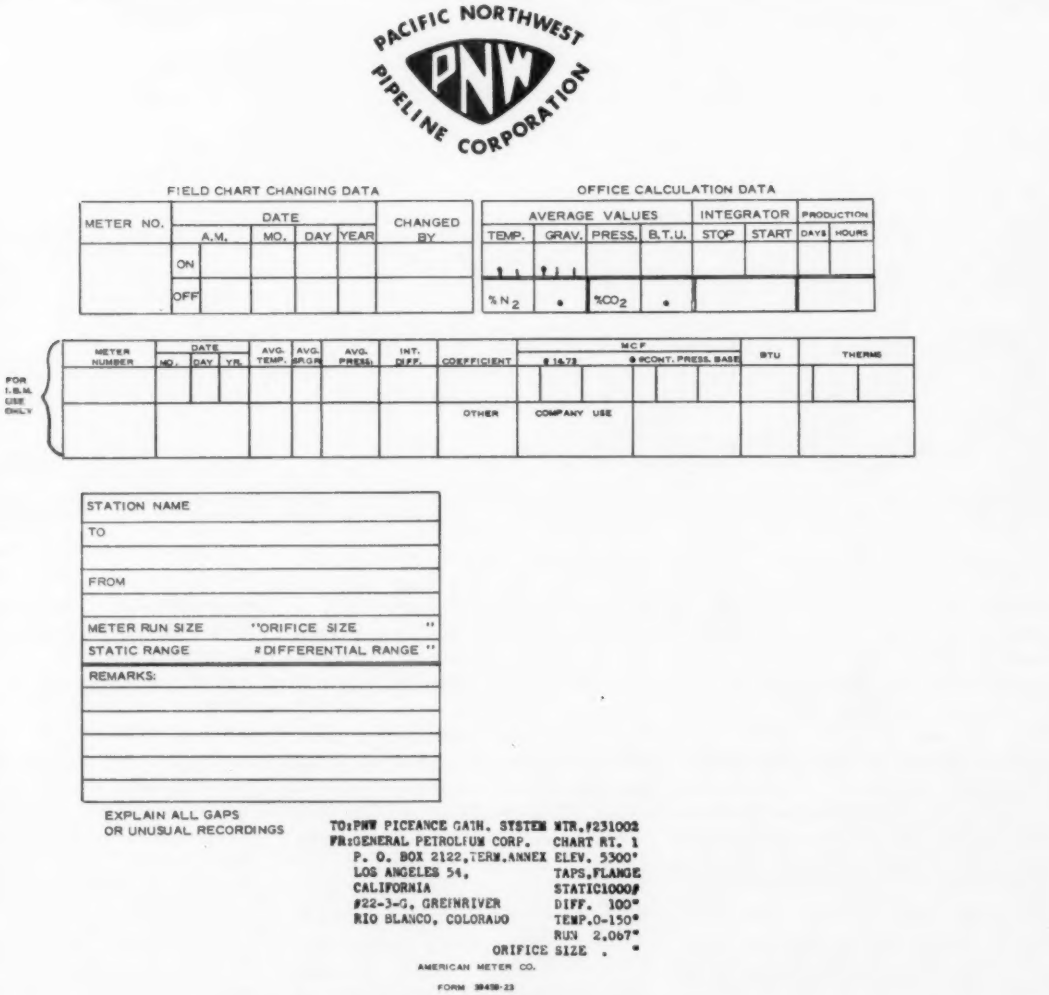


Fig. 8. Back printing on Pacific Northwest orifice meter chart.

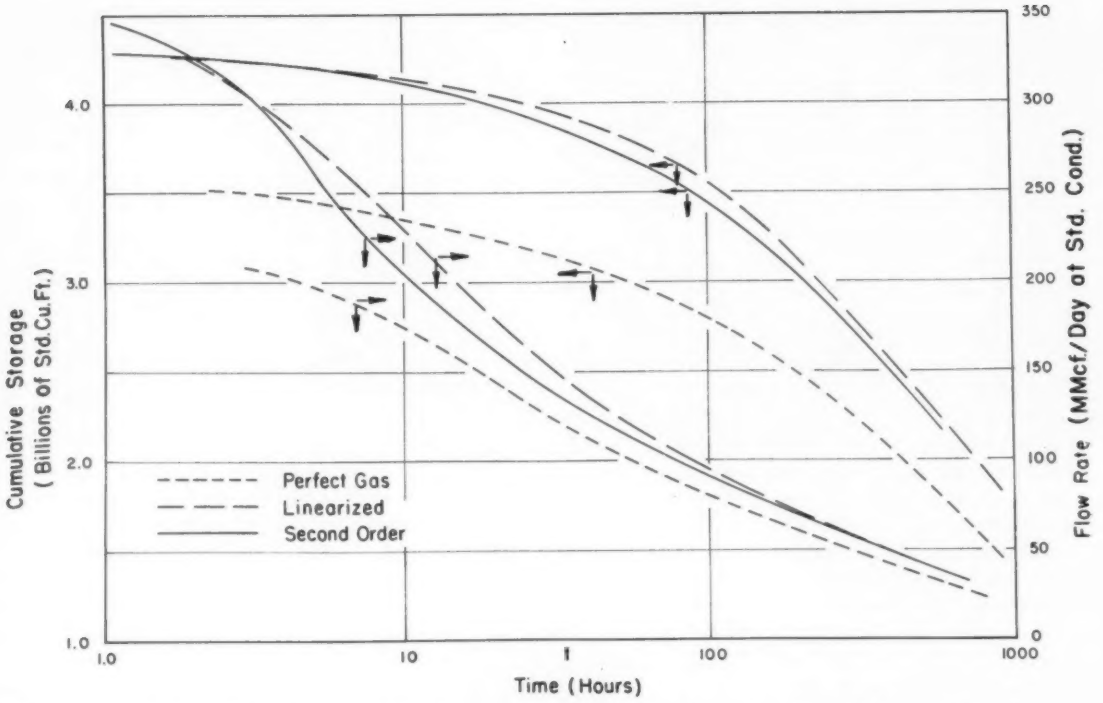


Chart shows plotted cumulative storage and flow history of gas reservoir, based on calculations made by computer.

A new method for . . .

Predicting behavior of gas storage reservoirs

By JOSEPH E. WARREN, Project Engineer
Gulf Research & Development Co., Harmarville, Pa.

A NEW solution for an old familiar problem has been introduced into the study of the unsteady-state behavior of gas storage reservoirs. The method of solution is at once more comprehensive and simpler than previously used methods. It was the result of a research project in the petroleum and natural gas engineering department at Pennsylvania State University.

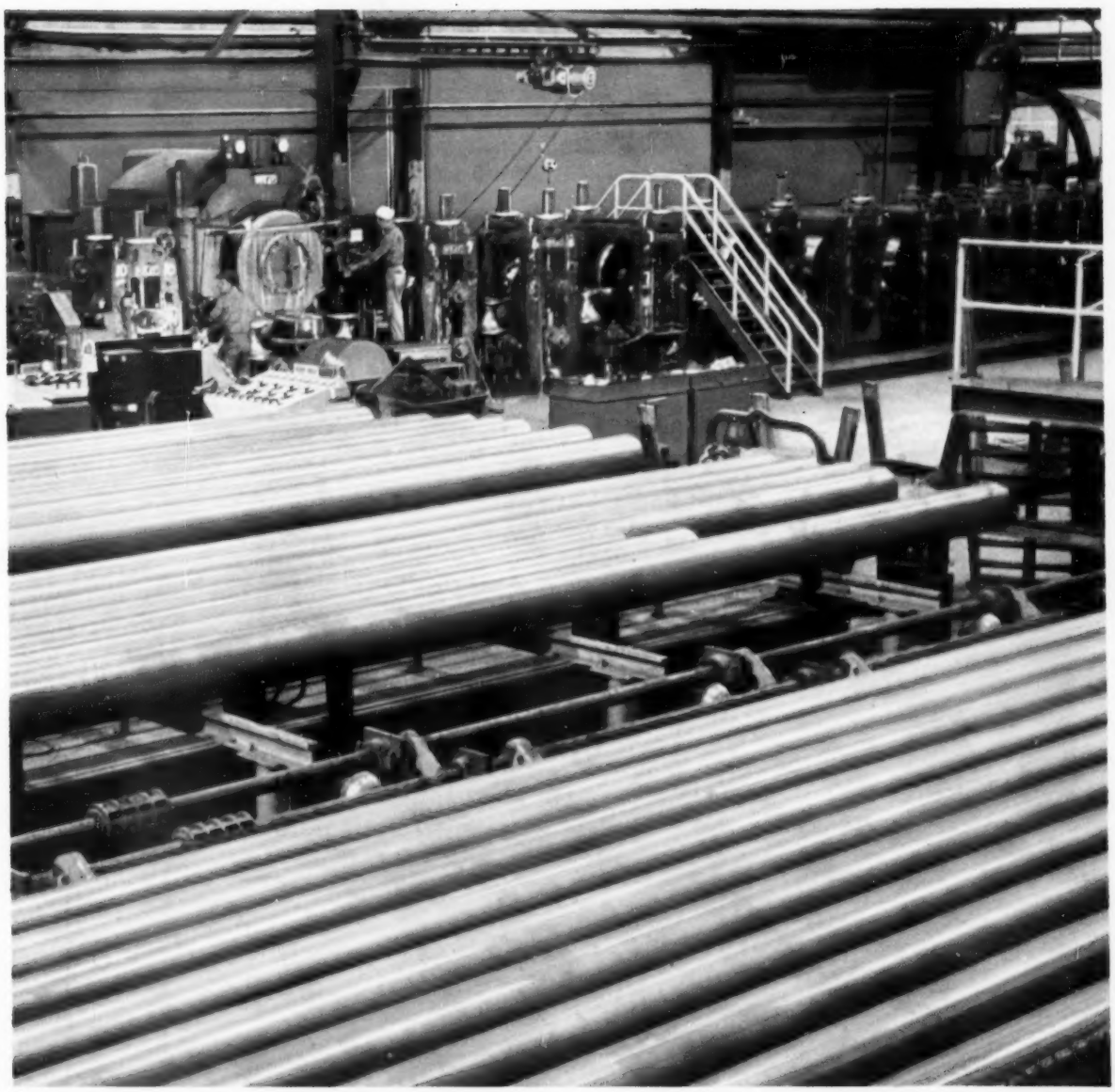
The method demands the flexible processing capabilities and high speeds of a general-purpose computer. The project, which was sponsored jointly by the AGA and several petroleum companies, was aided by the automatic programming development staff of Remington Rand Univac.

Transmission and distribution engineers are familiar with the need for precisely determining the operating characteristics of natural gas storage reservoirs. A mathematical description of reservoir behavior depicts the relationship between pressure and time at any point. This, in turn, will tell how much gas is stored at a given average pressure, and how much gas can be withdrawn or injected under given conditions at the well.

The prediction of deliverability under conditions of fluctuating demand requires an understanding of the pressure-distribution history of the reservoir under various conditions. Naturally, only the correct mathematical description of reservoir behavior will permit optimum use of reservoir and transmission-line capacity. The demand for gas at the withdrawal point—the point at which the transmission system feeds the metropolitan distribution system — will obviously be variable. These variations sometimes cover quite a wide range. Therefore, no storage reservoir can be intelligently evaluated by assuming steady-state conditions. As a consequence, transmission engineers have always been primarily interested in transient solutions to the equation that describes the flow of gas in a porous medium.

This behavior equation is a second-order partial differential of the parabolic and, as such, has no analytic solution. There are two ways of dealing with such a mathematical problem: one can linearize it by making certain simplifying assumptions or one can obtain solutions by numerical techniques.

The general method for linearizing the equation is to assume an average pressure throughout the time interval of interest. While the "average-pressure" assumption renders the equation amenable to solution, it deprives the solution of some meaning for actual predictive



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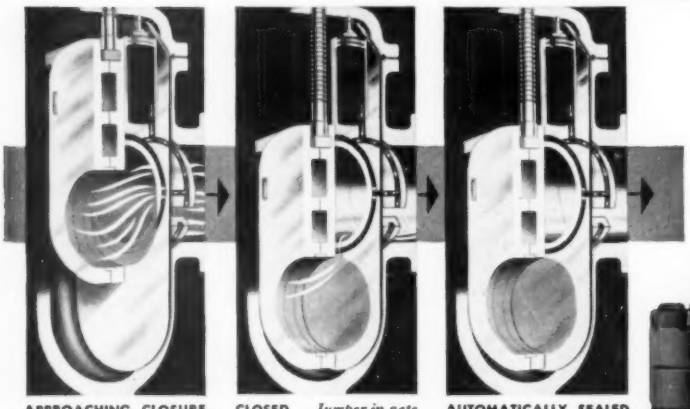

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purposes. The assumption introduces an error of considerable magnitude if the total change in the average pressure exceeds 10 per cent of the original value.

The numerical solution is far more satisfactory, but it involves a large number of highly repetitious computations. For this reason a high speed computer is not only best suited to the task but is required for a reasonable insurance against repeating errors.

There are two general types of numerical solutions possible. Of these, the more stable *implicit* method, producing highly useful answers, requires far more memory capacity of most computers available to transmission engineers; therefore, the explicit method—with its inherent danger of amplified roundoff errors—is usually used.

The problem under consideration involved predicting the behavior of reservoirs in which the effect of pressure on both compressibility and viscosity was considerable. By expanding the governing equation both in linearized and second-order form, the relationships between various pressure points in idealized and actual reservoirs were studied. Normalized equations in dimensionless form were solved and the results were transformed for practical use by the introduction of real parameters. The following conclusions were drawn:

The behavior of natural storage reservoirs can be predicted with reasonable accuracy. A fairly complete set of general solutions was obtained.

The "perfect gas" assumptions do not produce valid results for predictive purposes wherever compressibility and viscosity vary widely.

The expanded form of the governing equation can be solved numerically. It describes gas behavior more accurately than any linearized form, especially under fluctuating conditions. Because it contains two parameters, the expanded equation is not practical without a computing system having an internal memory that is fairly large and rapidly accessible.

Although large-capacity, general-purpose computers are in increasingly wide use throughout the petroleum and gas industries, there is a gap between the problem, as it exists in the engineer's mind, and the computer program for its solution. The Remington Rand Univac automatic programming development group came up with a bridge for that gap which pointed the way to practical application of the method developed.

The gap mentioned above is caused by the requirement that any problem must ultimately be given to a computing system in a language it can understand. Preparing the problem for the computer is called programming; the actual writing of instructions for the computer is usually referred to as coding. These functions are performed by a highly skilled type of expert called a programmer.

The practicing engineer can state his problem in conventional mathematical language; however, a computer programmer, although able to state any problem he understands in the computer's language, may not really comprehend the engineer's problem. Training either to understand the problems of the other is usually quite time-consuming.

The Univac automatic programming development group has long been familiar with this translation problem. As its director, Dr. Grace H. Hopper, remarked in 1953, "common sense dictates that we should, wherever possible, let the computer do the work of coding its own programs." For use on the gas problem, Dr. Hopper made available a compiling system developed by her group, and known by its code name, A-2.

A-2 is not a piece of machinery. It is a special type of Univac program that is recorded on a magnetic tape just as any other program is recorded. It functions as a translator. It can understand expressions very similar to the mathematical terms used by the engineer; and it translates these into lists of coded instructions for the Univac computing system. These instructions, recorded under A-2's direction on another tape, direct the computer through the solution of the problem.

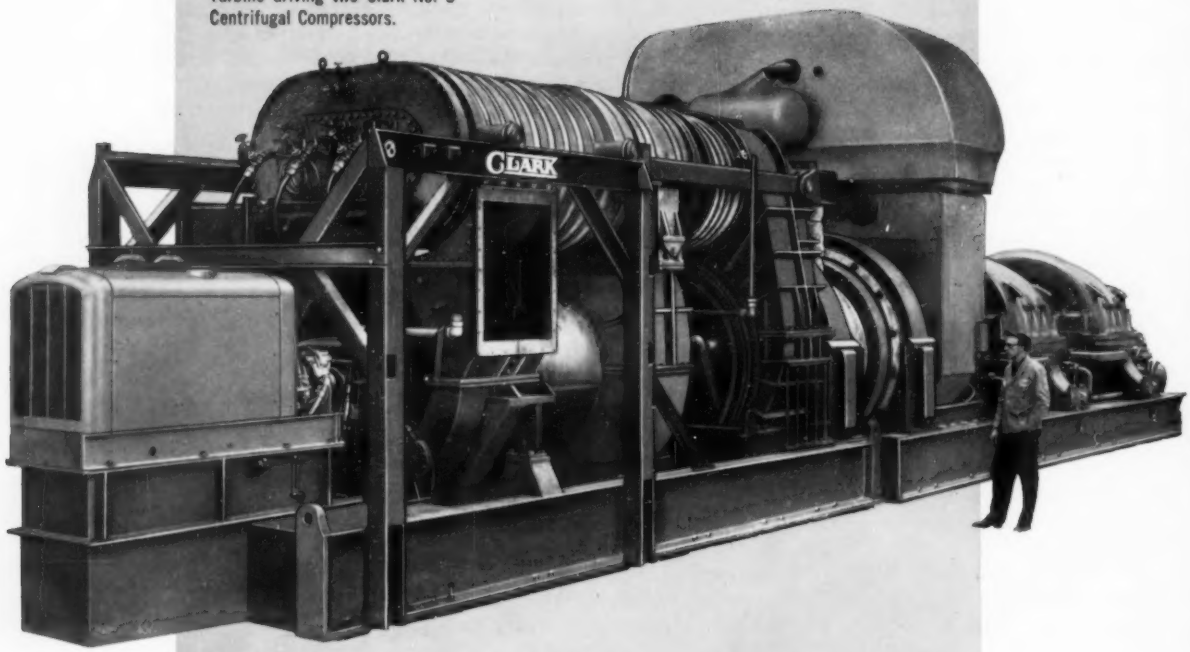
As Dr. Hopper's staff explained it, A-2 is a sort of encyclopedic dictionary indexing a library of instruction subroutines. These subroutines are chunks of programs constructed to do one simple mathematical job; e.g., taking a root, expanding a binomial expression, etc. The list of instructions given the compiler is actually only a reference list similar to a bibliography or a library card-file. The compiler looks up each "master instruction," picks the right chunk of computer coding, does what the computer people call "housekeeping" to fit it into its right place in the sequence, and thus ties together—or compiles—a complete, checked, working routine. It is not susceptible to error so the finished program does not have to be checked or debugged. When the compiler is through with it, it is ready to use.

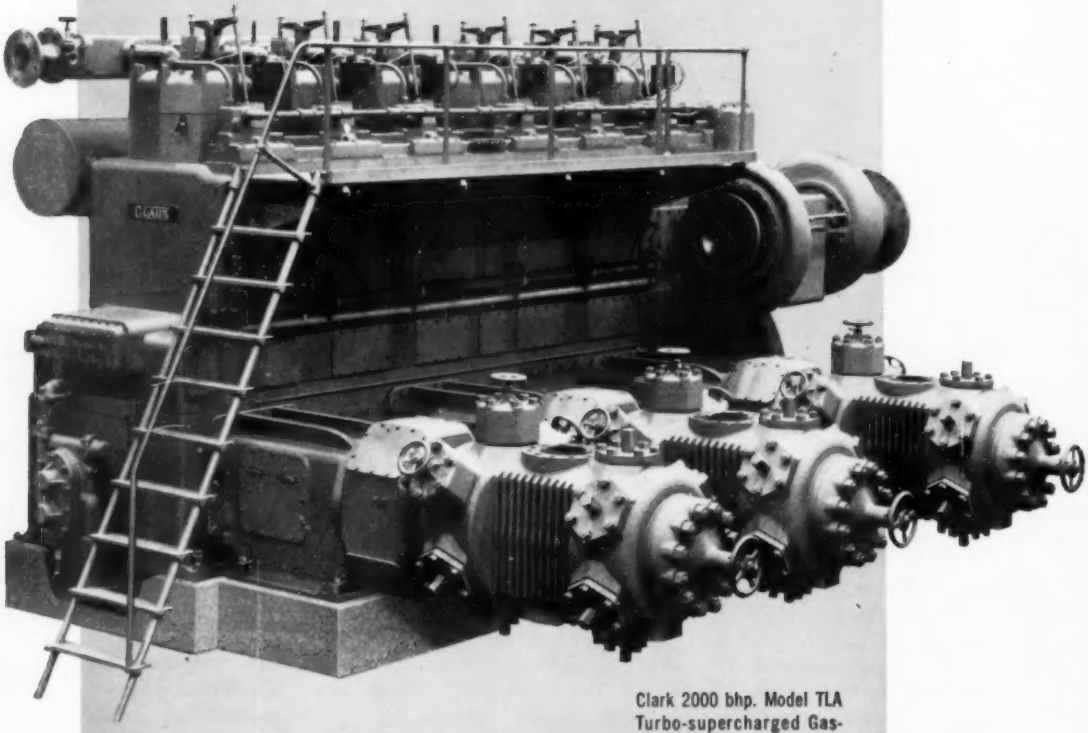
The importance of A-2 (and similar compiling or interpretive routine) is easily seen. To learn Univac programming would have taken from six to eight weeks: this time would have represented a digression from the basic research problem. Attempting to outline and explain the specialized problems of the transmission engineer to a computer programmer would have required several days at least, and the programmer would have spent several more days writing the instructions. Either the engineer or the programmer, working in what would have been a previously unexplored domain, could have made errors that might have rendered the work completely invalid.

Actually less than a day was needed to learn how to use the A-2 compiler; the learning process required only an understanding of its vocabulary, its abilities and its limitation. On the first day Univac was instructed, through A-2, to write a routine for a problem whose answers were already calculated. When Univac produced solutions that agreed with the previous calculations, confidence was established and the instructional period was over. In less than a day Univac had been programmed through a complicated mathematical problem with no previous knowledge about computer programming.

The master instructions for the actual problem at hand were then written including the statement of

Clark 8500 bhp. Model 302 Gas Turbine driving two Clark No. 5 Centrifugal Compressors.





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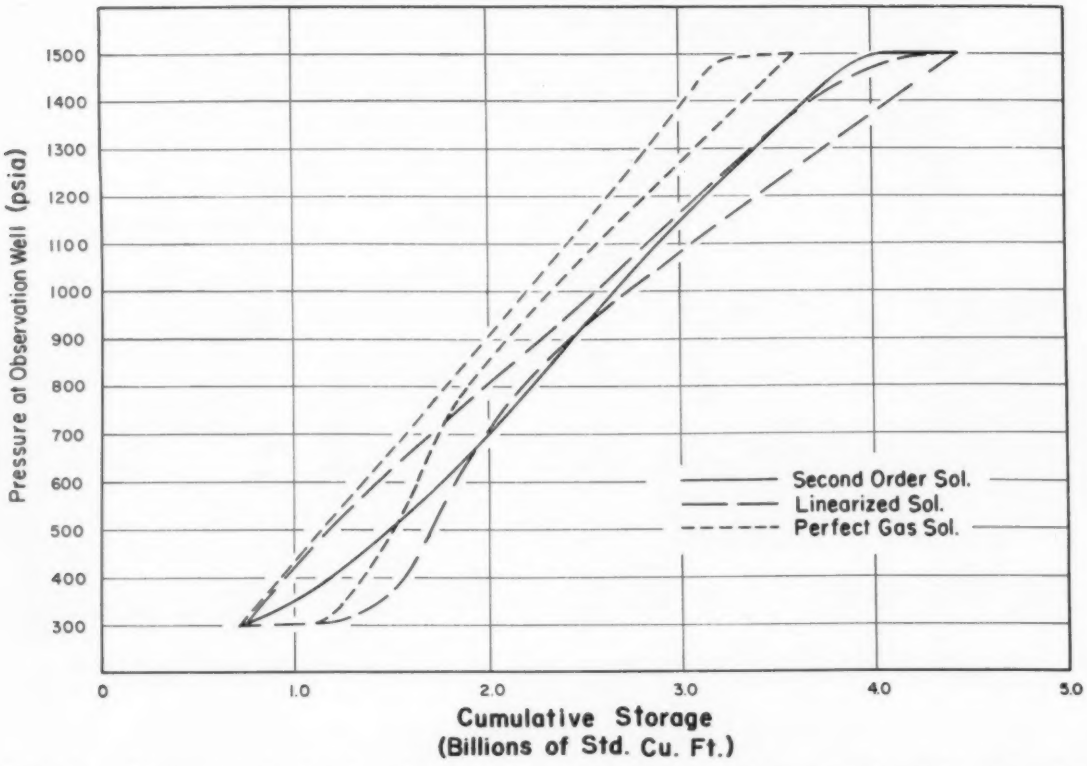

Observation well pressure as a function of cumulative storage, as determined by electronic computer using special programming.

the boundary conditions which applied. Univac took about 4.5 minutes to compile the running program from the A-2 library. This compiled program was then used to run the problem. The 4.5 minutes was the ultimate reduction of what might have been weeks of programming school or days of coordinated effort between the engineer and one or more computer programmers.

Because of a technical requirement of the Univac system, the program was performed in two parts. One, the normalizing run, took about 18 minutes of computer time. The other, the computation of the time steps comprising the actual analysis, took about 20 minutes. Printing the complex tables containing the computed values took only a few minutes for the high-speed printer.

The saving in time was remarkable. In a day the problem was put on the computer—without understanding, or needing to understand, how the computer was programmed. In less than an hour, the machine accomplished days of work. Actual comparison figures are impressive: the computing run for the expanded equation took 20 minutes on Univac; the computing run for the much simpler linearized equation on a punched-card calculator at Pennsylvania State University took over two hours. This same calculator would have been unable to solve the expanded equation in reasonable time since the ratio of the number of individual calculations between the linearized and expanded forms is $N:N^2$. Only the first 10 time-steps of the expanded equation, equivalent to one step of the linearized equation, would take about two weeks for an engineer working with a good desk calculator.

The compiled program gave results which proved valid for the applicable boundary conditions whenever they could be checked against physical data. For predictive purposes, the expanded equation removes the time-lag which the linearized solution introduces; thus, it eliminates the uncertainty in estimating flow capacity.

The dimensionless form of the equation is generally applicable—with different parameters, of course—to non-linear problems of liquid flow, to heat conduction problems where the conductivity coefficients are temperature dependent or to mass transfer problems where diffusivity is a function of concentration.

The increasing availability of large-scale digital computers in the gas industry should bring some relief for the engineer, who, all too frequently, has had inadequate computational facilities which necessitated the use of oversimplified mathematical models. While the programming staffs which complement existing and future computing systems in the industry may not be familiar enough with specific problems to offer much assistance to the engineer with a problem, the existence of automatic coding—such as the A-2 compiling system—will enable the engineer himself to prepare his work for computation. Since this is accomplished without requiring long sessions of classroom study to learn how these systems can be made to work, engineering ability is utilized to its maximum degree of efficiency. ■

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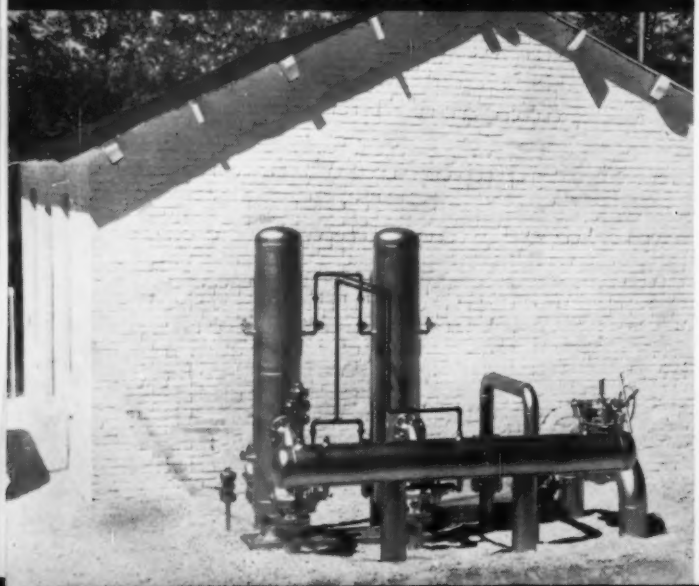
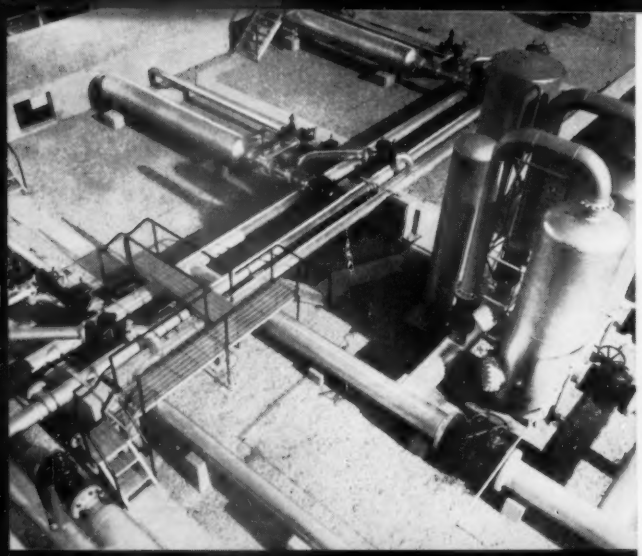


LOUISIANA



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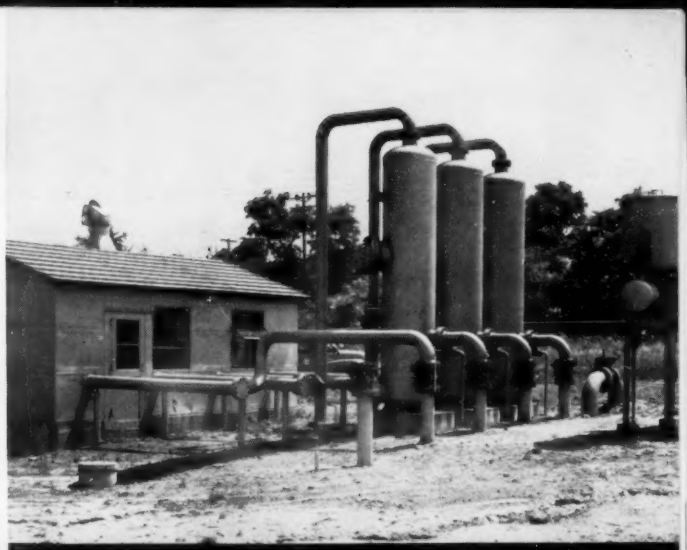

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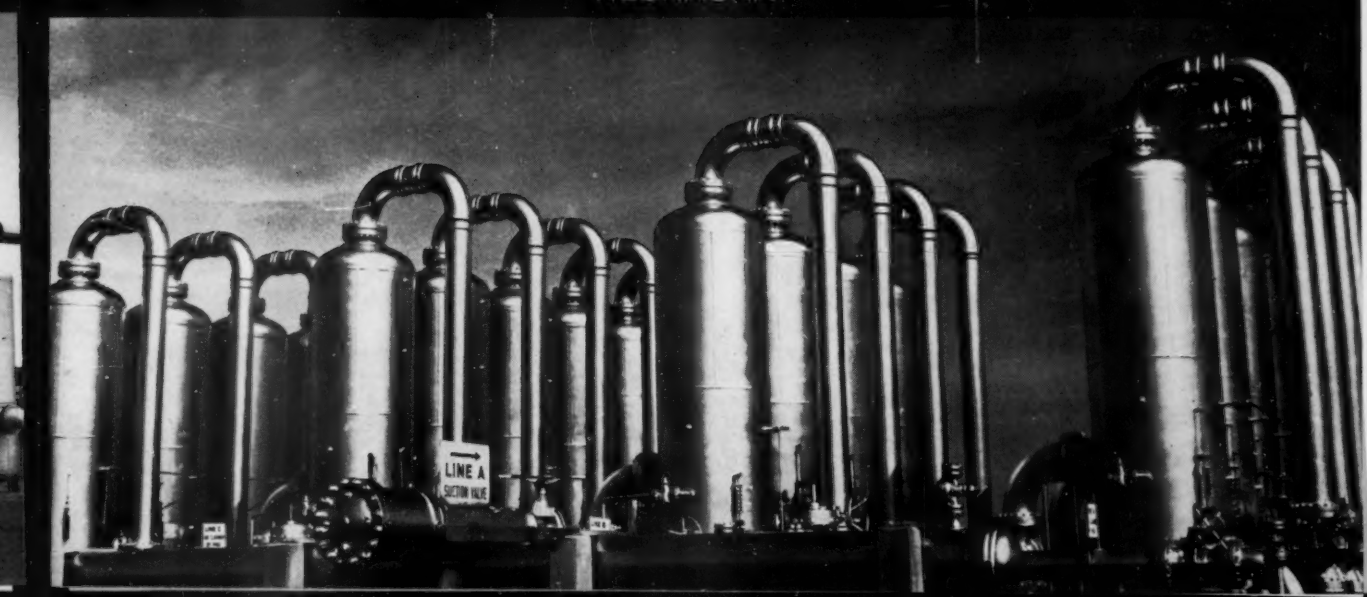
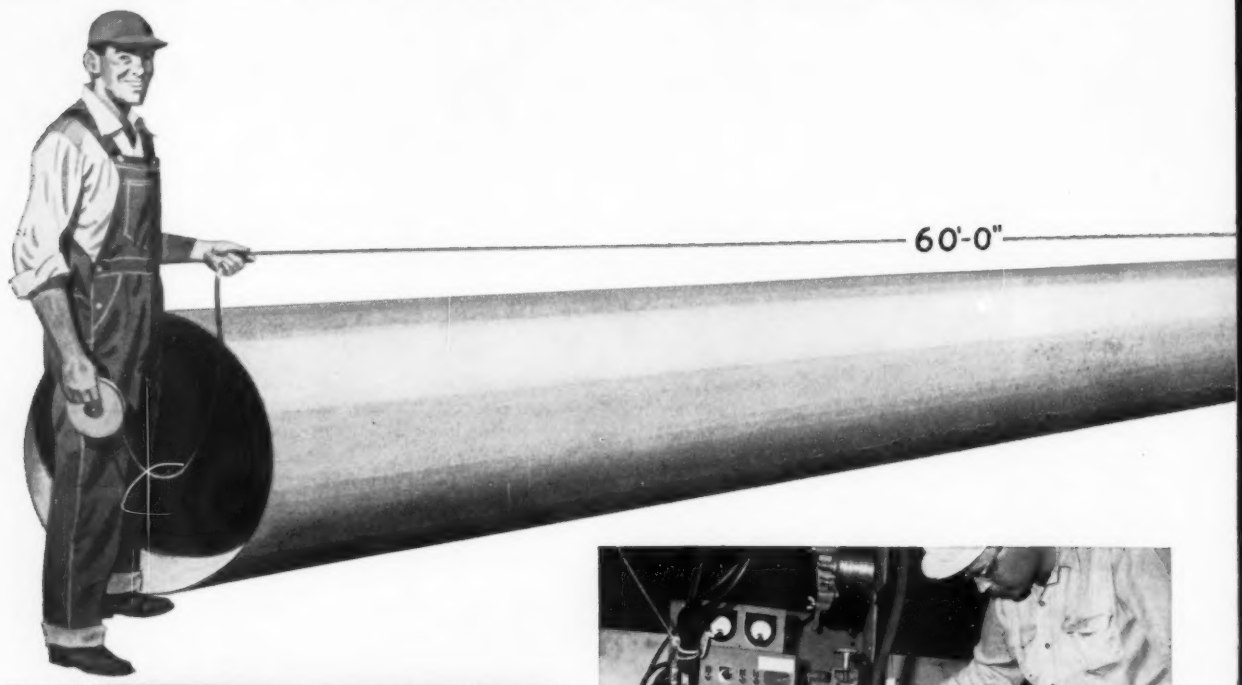
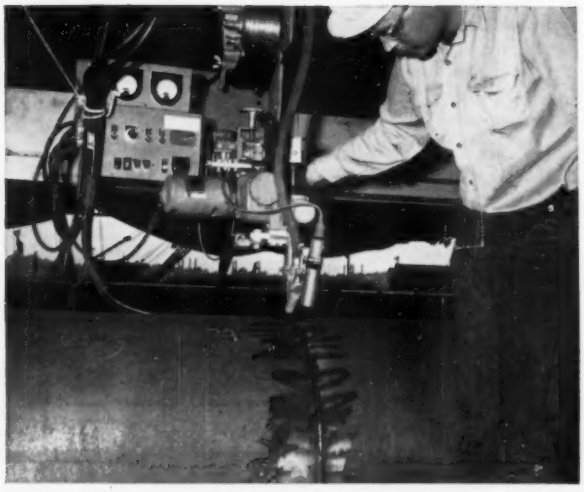


NEW "SUPER-SPAN" JOINTS LINE PIPE *speed schedules*



Stringer bead for joining two 30-foot joints of Republic Electric Fusion Weld Line Pipe is applied at "line-up" station. Perfect alignment is possible with precise separation of lands on rust-free bevel. Note rubber-tired rolls used to cradle pipe.



Here the first of two fully automatic passes is made by submerged arc welding, employing latest equipment and methods. The finished mid-weld of Republic's new "Super-Span" Pipe is as reliable as the longitudinal weld.

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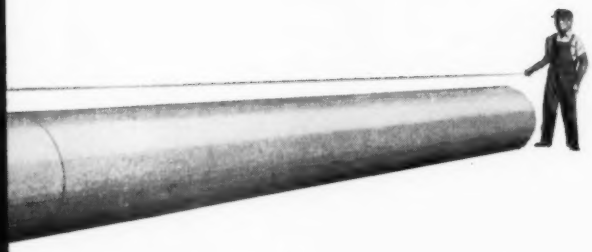

Sixty feet in length, these extended joints of Republic Fusion Weld Pipe require only 88 welds to make up a mile of line. Progressing at the rate of 150 girth welds per day—about par for welding-crews under normal conditions—daily production will total 9000 feet.

Compare this to the 6000 feet of line you complete using 40-foot joints. It adds up to a minimum savings of 33⅓% in laying time when you use the new Super-Spans. In a 500-mile line, for example, the *savings* would amount to *147 working days!*

This new, economical length, a Republic exclusive, is produced by joining two 30-foot joints under ideal welding conditions. Each welding operation is carefully controlled, resulting in a mid-weld of equal quality to the longitudinal weld.

Consistent uniformity like this is standard in every joint of Republic Electric Fusion Weld Line Pipe. Great care is taken to be certain circumference is always constant. This permits fast, accurate line-up for high-speed girth welding. Uniform wall thickness assures an even distribution of metal all around the pipe—with no thin spots to worry about. Precision manufacturing techniques produce high ductility and yield strength, to keep maximum dependability in high-pressure service.

Republic, a leading pipe producer for more than 25 years, makes steel pipe for every oil and gas handling need. Electric Fusion Weld comes in sizes from 24″ through 30″ O.D.; Electric Resistance Weld from 2⅜″ through 16″ O.D.; and Continuous Butt Weld from ¼″ through 4″ nominal.

Get all the facts from your local Republic office. Or mail coupon for literature.

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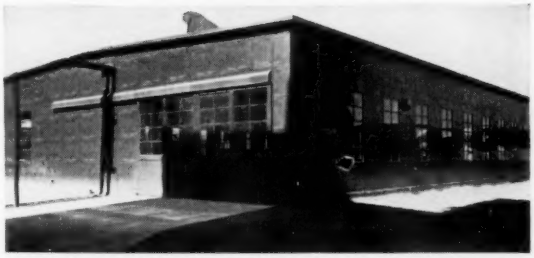

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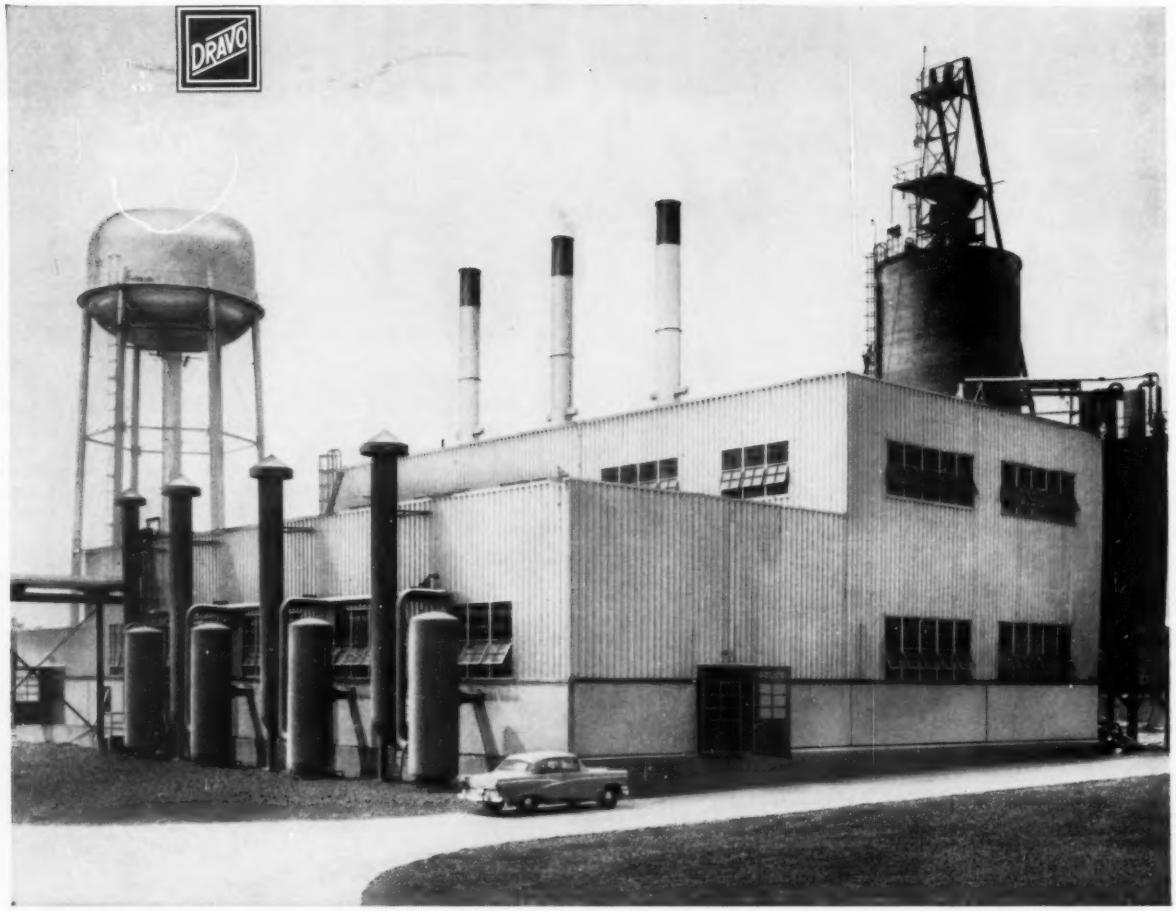

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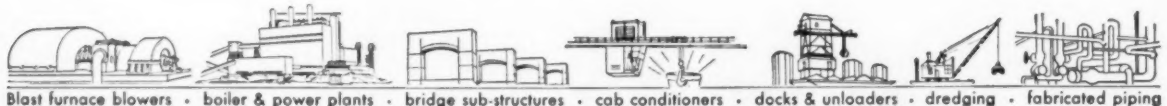

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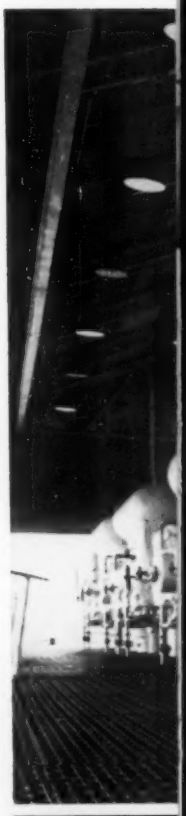
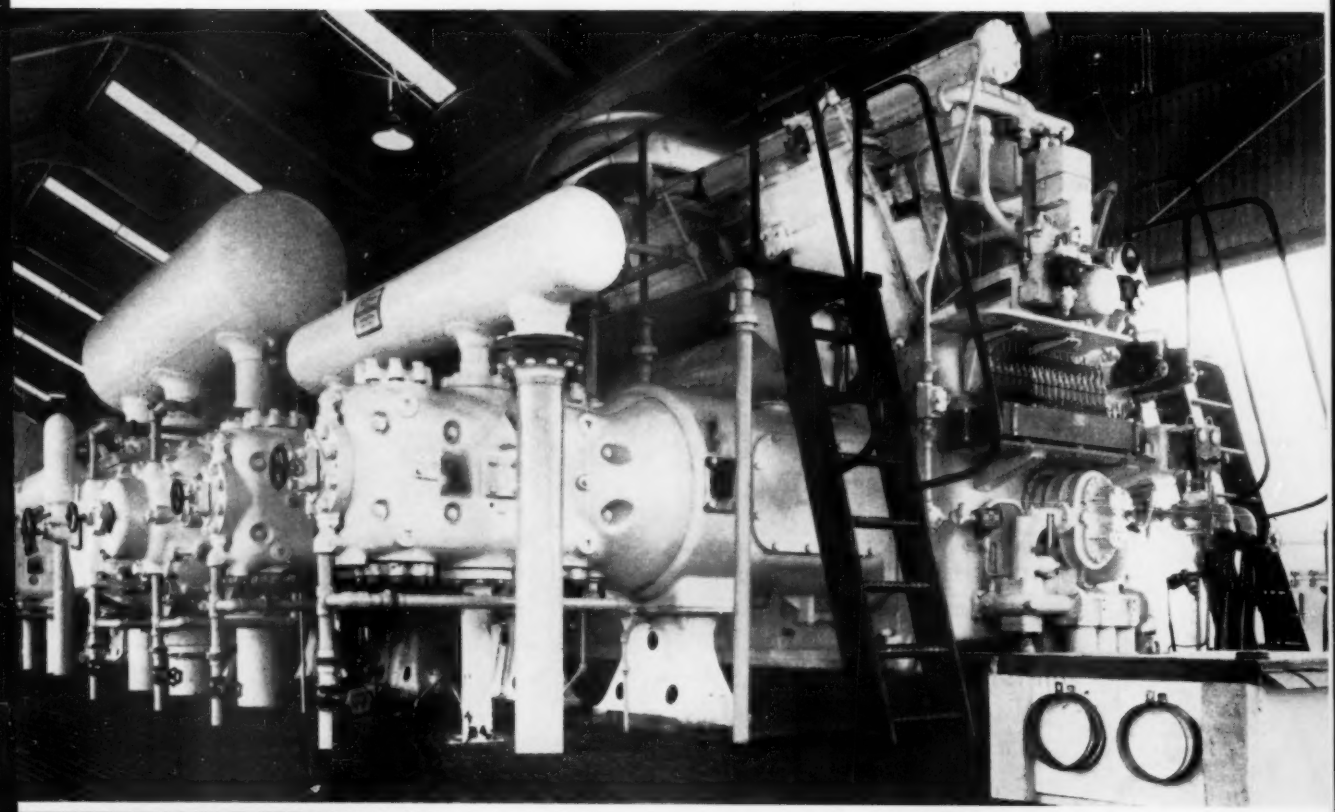
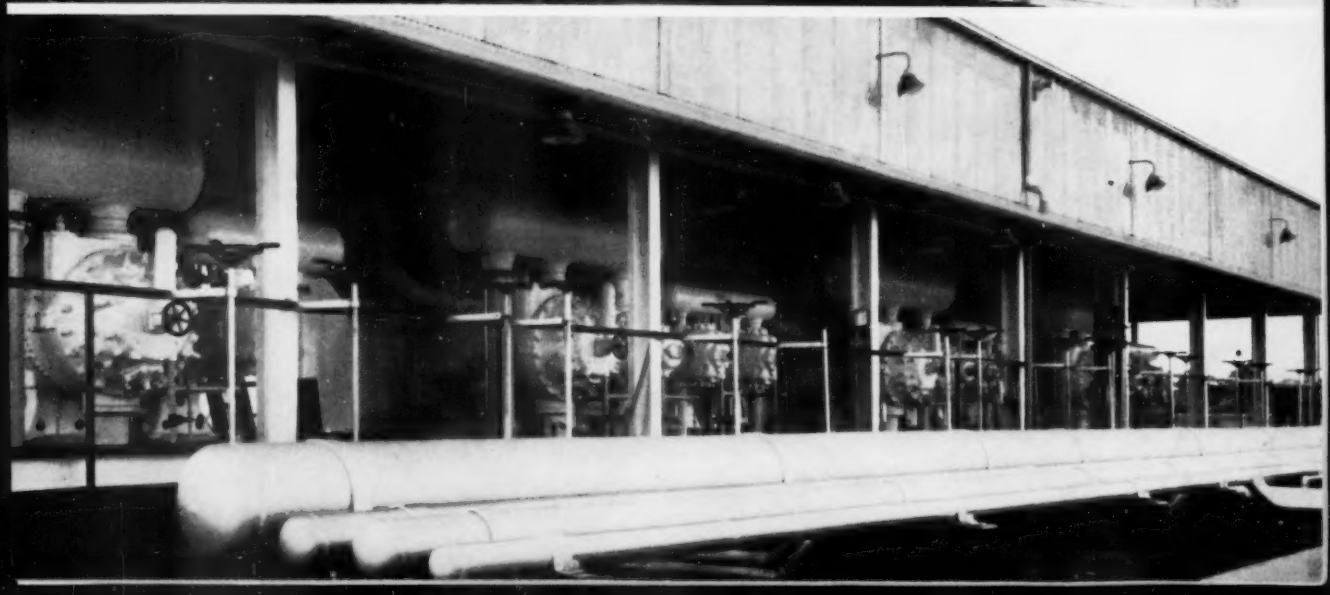


A *In the Fairbanks station of The Liquigas Company, a subsidiary of The Murmanill Corporation . . . three 8-cylinder Cooper-Bessemer GMVA's rated 1100 hp at 300 rpm and one 4-cylinder GMVA rated 540 hp at 300 rpm.*

B *Noted for "pulling ability", Cooper-Bessemer engine-driven compressors at Fairbanks deliver long-life service with minimum maintenance.*





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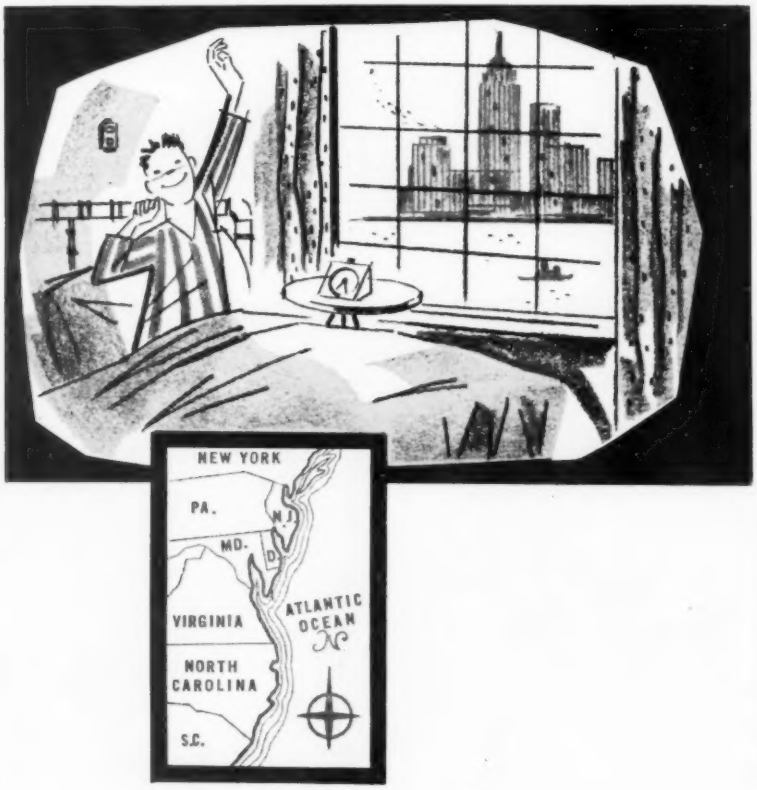

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GAS pipeline people

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W. A. CARROLL, JR. has been named general sales manager of the industrial silencer division of Burgess-Manning Co. Mr. Carroll has served as New York district manager of the company for several years. He will headquarter in Dallas. R. T. OLIVER, JR. of the New York office has been promoted to New York district manager.

CLYDE C. COOPER has been named superintendent of measurement for Northern Natural Gas Co., Omaha. He replaces J. L. GRIFFIN, who retired recently after 27 years with the company. Mr. Cooper, who has been assistant superintendent since 1948, has 25 years service with Northern.

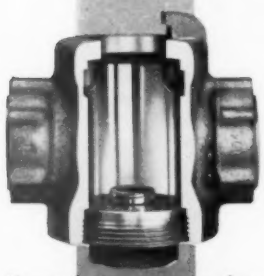
DAVID W. PEAKE has been made a full partner of S. D. Day Co., Houston. Mr. Peake joined Day in 1950 and spent some time obtaining practical experience in the field with pipeline crews. Subsequently he became sales manager responsible for all marketing operations, including advertising, promotion and public relations.

EARL P. MARTIN has been promoted by Cooper-Bessemer Corp. to assistant branch manager of the Houston office. Mr. Martin joined Cooper-Bessemer in 1939 and most recently served as a senior sales engineer.

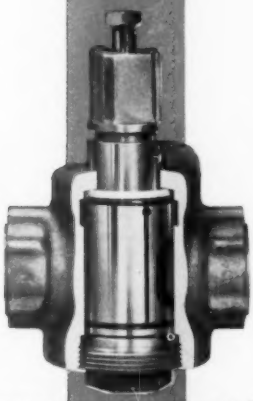
David Peake
S. D. Day

Clyde Cooper
Northern

Plug rotates as journal



Smooth bearing-surface in body



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bearing-smooth operation.. PLUS A TIGHT SEAL

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Sizes: ½" through 30".

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acf Valves on natural gas manifold at compressor plant in Pennsylvania.

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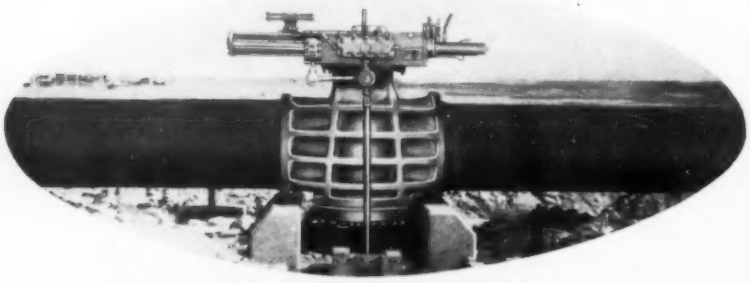
*DuPont's tetrafluoroethylene resin. acf is a registered trademark of acf Industries, Inc.

Ledeen Gate Valve Operator with integral gas powered hydraulic oil system mounted on buried main line block valve.

Ledeen VALVE OPERATORS
FOR THE GAS INDUSTRY



Ledeen Quad Plug Valve Operator with auxiliary manual hydraulic control on compressor station block valve.

Whether you use gate or plug valves in your large gas lines, Ledeen has one of the most complete lines of operators and controls available for their automatic operation.

No matter what size valve is involved, write or call Ledeen for engineered recommendations.

Ledeen MFG. CO.

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El Monte, California

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WRITE FOR BULLETIN 3020

pipeline people • *Cont'd.*

WARREN L. TAYLOR has been named to the newly created post of chief geologist for El Paso (Texas) Natural Gas Co. Until recently, he served as division superintendent at Salt Lake City.

Other changes in the geological and reservoir engineering department include formation of a new division office at Amarillo, and appointment of new superintendents at three of the company's five geological divisions. A. E. MILLER, JR. is superintendent of the new Amarillo division; J. G. WILKINS succeeds Mr. Taylor as Salt Lake superintendent; ROY L. PRICHARD is superintendent at Farmington; N. M., replacing WILLIAM L. SPEER; and LARRY ZINK is superintendent at Midland, Texas, replacing ROY ALLEN. Both Allen and Speer recently were transferred to El Paso Natural Gas Products Co.

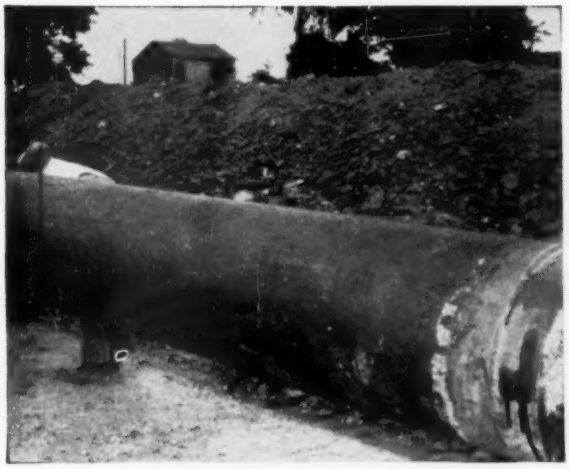
CHARLES E. PUTMAN, JR. has been named to the new post of field superintendent of Lone Star Gas Co.'s compressor department. He will supervise and coordinate operations of all transmission, field and underground gas storage compressor stations operated by Lone Star in Texas and Oklahoma. He will continue to headquarter in Joshua. Succeeding Mr. Putman as Joshua compressor station superintendent is SETH DAVIS. HAROLD C. BRAWNER is assistant superintendent.

DONALD M. JOHNSTON has joined Trans-Canada Pipe Lines Ltd. as assistant general counsel and assistant secretary.

ROBERT O. GARRETT, vice president and general manager of Texas Gas Exploration Corp., Houston, has been elected to the company's board of directors. JAMES W. O'KEEFE was elected treasurer of

Warren Taylor
El Paso

Robert Garrett
Texas Gas



Pipe, buried for 25 years, is good as new

Applying NO-OX-ID "GG" over the cleaned surface

Next, No. 4 NO-OX-IDized wrapper for protection against abrasion

Finally, NO-OX-ID Filler Red "C," a seal coat, completes protection

THIS PIPE IS 25 YEARS YOUNG

Twenty-five years ago NO-OX-ID combinations sealed this pipe against corrosion. Today, after two and one-half decades of uninterrupted service, the pipe is as good as new.

HOW DO WE KNOW THIS?

Recently, new construction made relocation of the line necessary. Inspection revealed the original NO-OX-ID coatings and wrappers had chemically and mechanically stopped moisture penetration and corrosive attack. *Not a foot of pipe was replaced.* After cleaning and a new application of NO-OX-ID coating-wrapper combination, the pipe was lowered in. It's now ready for many more years of additional service.

Many leading pipeline companies and utilities rely on NO-OX-ID combinations for lasting pipeline protection. Consult your Dearborn representative next time you move pipe or lay new lines for the right combination to meet your soil conditions.

NO-OX-ID ADVANTAGES

Coats more feet per man-hours because less material is needed • Applied hot or cold • By hand, by Traveliner or at the mill • Requires less equipment • No noxious fumes.

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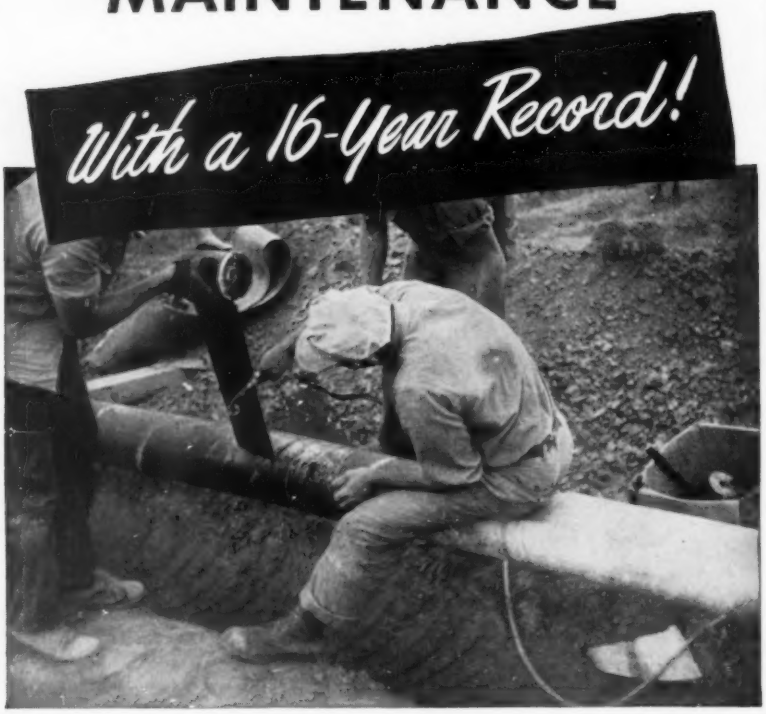
Company.....
Address.....
City.....*Zone*....*State*.....

PREVENTIVE MAINTENANCE



GIVE PIPE, PIPE JOINTS, FITTINGS and COUPLINGS THE *QUALITY PROTECTION* BUILT INTO

Time-Tested **TAPECOAT®**

To reduce maintenance costs on distribution lines, you need the best possible protection you can get at lowest possible cost. Since 1941, TAPECOAT has led the way in providing dependable, low-cost preventive maintenance on gas lines in underground service.

Today, the performance of this original coal tar coating in handy tape form is more important than ever in your maintenance picture. Equal in effectiveness to mill coating on the pipe, TAPECOAT gives your lines the continuing protection of coal tar. It can be applied *positively* because it has its own perfect bond. No skilled help is required because it is simple to spiral-wrap with the use of a torch. And once TAPECOAT is on, you know from its 16-year record that it will give you uninterrupted protection.

TAPECOAT comes in rolls of 2″, 3″, 4″, 6″, 18″ and 24″ widths. Also available in asphalt. Find out today how it can fit into your preventive maintenance program and help you save time, labor, material and money.

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pipeline people • *Cont'd.*

the company and W. J. WOOTEN was appointed manager of its land department.

Natural Gas Pipeline Co. of America has made several appointments at its Fritch, Beatrice, and Minneola plants. T. R. BRENNAN was named field superintendent of compressor stations (gathering system), and J. E. BULLOCK was named field superintendent of compressor stations (mainline). In other appointments, L. L. STALLARD and D. R. WENDELE were named superintendent and assistant superintendent, respectively, at Station 111, Fritch, Texas; and C. J. FITZGERALD was appointed superintendent of Station 103, Minneola, Kan.

Tennessee Gas Transmission Co., Houston, has established a new district office at Durango, Colo. JOHN SIMONS, formerly district geologist at TGT's Salt Lake City office, is manager of the new exploration district. Others assigned to the Durango office are J. D. MOON, district landman, and C. S. ALGIRE, geologist. A. N. MCDOWELL, former Gulf Coast exploration division manager, is being transferred to Calgary, Alberta, as manager of the Canadian exploration division. J. P. ROACH succeeds him in the Gulf Coast post. In other Houston changes, J. SPENCER COLLINS has been promoted from staff geologist to staff manager; L. B. VADEN and GEORGE BURGHER, both formerly staff landmen, are land activities supervisors; and J. M. BROWNING, formerly district exploration manager in Calgary, is staff geologist.

LANGDON DEARBORN has been appointed vice president and general manager of Houston (Texas) Natural Gas Production Co. He also becomes a director of the production company, wholly owned subsidiary of Houston Natural Gas Corp.

W. J. Wooten
Texas Gas

James O'Keefe
Texas Gas

Bendix Aviation Corp.'s computer division has opened a district sales office in New York and named W. E. STAFF, JR. as supervisor of the new eastern district office.

KENNETH W. O'CONNOR has been appointed southern Texas regional sales manager of Tubular Lining Corp., Houston.

WYATT NORMAN has joined Trunkline Gas Co., Houston, as district landman with headquarters in Corpus Christi.

ROBERT L. GRUNEWALD has been named manager-manufacturing for General Electric Co.'s gas turbine department.

John Saussaman
Kaiser

P. H. Spennetta
J. I. Case

JOHN D. SAUSSAMAN has been appointed division superintendent in the Iron and Steel Divisions of Kaiser Steel Corp., Fontana, Calif.

ROBERT L. ANDERSON has been appointed representative of the pipeline market section, sales development division of Caterpillar Tractor Co.

WARREN F. KANE has been appointed district manager of the Clark Pacific district of Clark Bros. Co., Olean, N. Y. He will headquarter in Los Angeles. He was a sales engineer in Clark's Tulsa office before becoming overseas sales manager of the company's export division.

P. H. SPENNETTA, former chief of research and testing for Caterpillar Tractor Co., has joined the engineering staff of J. I. Case Co., Racine, Wis., as director of engineering for the industrial division. T. A. HALLER, former Case director of engineering, is heading up the newly established research and development center in Racine.

GAS pipeline news

$615 million construction authorized by FPC

Gas facilities estimated to cost more than $615.9 million were authorized by the FPC during the 12 months ended June 30. Nearly 6800 miles of line and approximately 350,000 hp in compressor units were included in the authorizations.

FPC Chairman Jerome Kuykendall said the new facilities are designed to add 2.25 billion cu ft of daily delivery capacity to the nation's transmission systems.

Major projects—those estimated to cost $700,000 or more each—accounted for approximately $606 million of the total construction. These major projects will increase daily capacity of systems involved by more than 2.1 billion cu ft of gas per dav. One hundred and sixty-six cities of 50,000 population or more in 32 states and the District of Columbia, as well as numerous smaller communities, are expected to benefit from these large projects.

Texas Eastern Transmission Corp., Shreveport, received the largest certificate authorization, granted in two parts. Involved was a substantial increase and replacement in system capacity. Replacement involved resulted from the reconversion of the Little Inch line to petroleum products. It covered 422 miles of 30-in. line in Texas, 530 miles of 30-in. mainline loops from Mississippi to Pennsylvania, 208 miles of miscellaneous sales, supply and transmission laterals, and 72,300 hp in new and existing compressor stations.

The $138.5 million job enables Texas Eastern to import gas from Mexico and increase its system sales capacity by 455 MMcf/day.

Chairman Kuykendall noted that while there was a substantial increase in the total mileage, horsepower and estimated cost of the facilities authorized during 1956-1957 period compared with the previous period, the increase in delivery capacity was approximately the same—2.25 billion cu ft. He said that the increase in facilities and cost in the current report was not reflected in additional delivery capacity because of the increasing number of projects involving the improvement and assurance of service to customers through acquisition of additional gas reserves, expansion of storage facilities, or the rearrangement and replacement of less efficient and antiquated facilities.

Gulf gathering system makes rapid progress

Completion date for the gas gathering system in the Gulf of Mexico which will add 1.7 trillion cu ft of gas to the Tennessee Gas Transmission Co. system is Dec. 15.

The system is the biggest yet built to tap the gas reserves under the Gulf of Mexico.

About 2500 ft of 26-in. coated pipe is laid each day by this 300-ft lay barge. The barge, which is 60 ft wide and 19 ft deep, was built and outfitted particularly for this job in the record time of nine weeks.

pipeline news • *Cont'd.*

Brown & Root Inc. is constructing the marine section of the Kinder-CATC pipeline. The whole system consists of approximately 107 miles of 26-, 20-, 16-, and 12-in. pipe which will connect CATC and Magnolia - Continental - Newmont producing wells off Cameron parish, La., with TGT's Kinder compressor station.

Three pipe-laying barges are working around the clock on the 60-mile marine section of the system. Daily Brown & Root's new 300-ft lay barge, the M-211, puts approximately 2500 ft of the 26-in. concrete-coated pipe on the floor of the Gulf. Two small barges are at work on the smaller diameter sections of the line.

A new feature built on the M-211 is a "stinger" devised by the builder's pipeline department. It is a cradle with controlled buoyancy 356 ft long attached to the end of the barge. It allows the concrete-coated pipe to be lowered in a very gentle curve so as not to crack the coating.

From Kinder the offshore gas will enter TGT's 540-mile, 30-in. line to the Portland, Tenn., compressor station. Portland is the approximate mid-point of the company's main multiple line which extends 2200 miles from south Texas into northern New England.

Gathering, processing plant proposed

A $14 million gas gathering and processing plant in the Steelman area of southeastern Saskatchewan is proposed in the interim report of Dome Exploration (Western) Ltd.

According to the report, the plant will be a joint venture between Dome and Provo Gas Producers Ltd., with the new company to be known as Steelman Gas Ltd.

Substantial quantities of propane, butane, natural gasoline, and a small amount of sulfur will be produced. The plant will be capable of processing up to 45 MMcf/day of raw gas.

Pipe line bonds offered by Texas Eastern

Texas Eastern Transmission Corp. is offering $30 million first mortgage pipe line bonds through an investment banking group headed by Dillon, Read & Co., Inc.

Proceeds from the sale of these securities will be used by the company in connection with its $235 million program covering an increase of 250 MMcf/day in the delivery capacity of its system and the reconversion of a major portion of the Little Inch. Of this amount, approximately $214 million was provided by previous financings, and the balance will be provided by the sale of the bonds. The remainder of the proceeds from the current sale will be used by the company for another current authorized expansion program estimated to cost $30 million.

Request denied for more heating customers

Michigan Wisconsin Pipe Line Co.'s request to increase gas deliveries to existing customers in order to permit them to attach additional space heating customers has been turned down by the FPC. The commission denied the request because it was based on gas supplies now available on only a temporary basis.

OUR AIM:

TO BUILD
BETTER PIPE LINES
ON SCHEDULE
AT THE LEAST
POSSIBLE COST

Houston
CONTRACTING COMPANY
GENERAL CONTRACTORS
Laurence H. Favrot • R. P. Gregory • Geo. A. Peterkin

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GASOLINE
WATER PIPE LINES

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USER BENEFIT No. 5

VERSATILITY

got GARRETT RELIEF VALVES

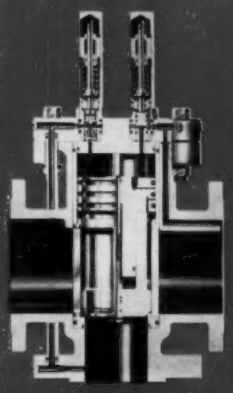
Look the field over and you'll not find another valve that offers as much as the Garrett Relief Valve.

First, there's unequalled accuracy and dependability, obtained by placing opening and closing functions in two controls that are entirely independent of each other. The differential-area design allows a pressure-opened, pressure-closed main plunger that is free of the inconsistencies present when a large, stiff spring is used.

Secondly, the Garrett Valve may be used as a blowdown valve without affecting its function as a relief valve. Through the addition of a simple Garrett "operator," a solenoid valve or other suitable control, it can be opened manually from a remote location, or tied into an automatic safety shut-down system. This versatile valve can be applied to almost any piping layout. And of great importance to present users, existing Garrett Valves may be equipped for remote control or safety shut-down without even taking them out of the line!

For a complete explanation of these and other reasons why Garrett Valves have become "standard" on so many transmission and distribution systems, contact your nearest Garrett representative or write for Bulletin No. RV-103.

REPRESENTATIVES THROUGHOUT THE UNITED STATES AND ABROAD



Garrett Type "D" Relief Valve. Sizes, 1" through 8", single or dual outlets, for working pressures from 150 to 5000 psi. Supplied with soft or hard seats, screwed or flanged connections.

Garrett Type "E" Relief Valve. Sizes, 1" through 8", for working pressures from 25 to 200 psi. Soft or hard seats, screwed or flanged connections.

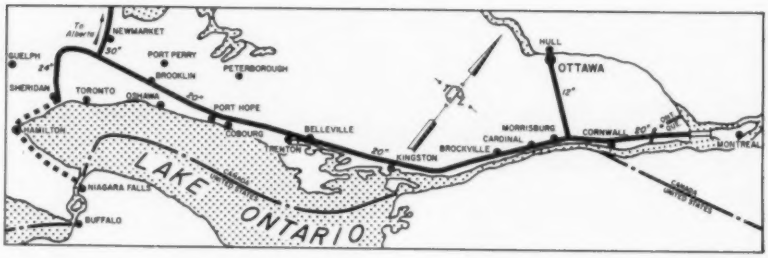
Garrett Oil Tools, Inc.
P. O. BOX 2427 • LONGVIEW, TEXAS

DIVISION OF [illegible] INDUSTRIES, INC.

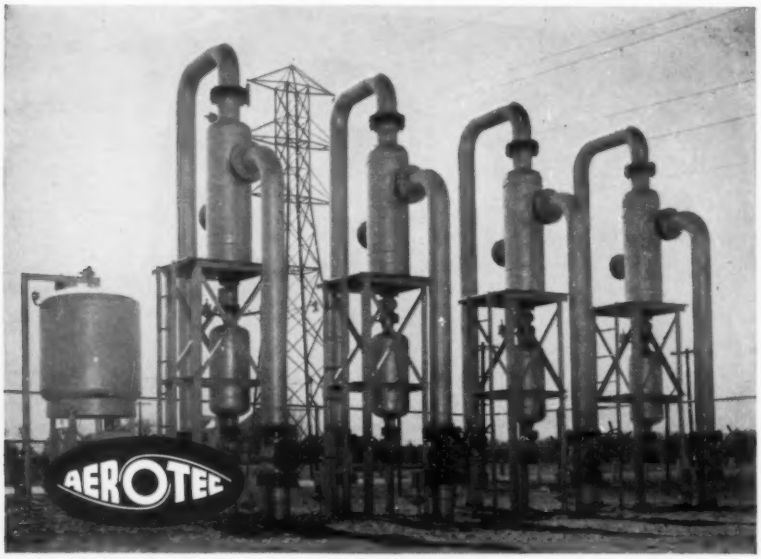
pipeline news • *Cont'd.*

The FPC told the company that it would be appropriate for Michigan Wisconsin to make the necessary filings to provide for service to 6658 space heating customers in communities which it had not previously served, as authorized by prior FPC orders.

This temporary supply is complicated by proceedings involving the system expansion of American Louisiana Pipe Line Co., Michigan's supplier, and a proposal by Panhandle Eastern Pipe Line Co. to abandon sales to Michigan Consolidated Gas Co. American Louisiana proposes to deliver a portion of its increased sales capacity to Michigan Consolidated.



Due for completion this year is the Toronto-Montreal section of Trans-Canada's line. Work is progressing at five locations along the 310-mile, 20-in. line. Construction is under way too on the 33-mile, 24-in. link connecting the Toronto-Montreal section with T-C's Niagara-Toronto line. Also slated for completion this year is the 36-mile, 12-incher between Morrisburg, on the Toronto-Montreal section, and Ottawa.



cleaning gas without wetting agents

These four Aerotec Gas Scrubbers, operating in parallel, were installed by a large utility to clean the gas at the entrance to the Albany, New York distributing station.

Dry clean gas is a necessity at this critical point, and these units have been serving the community for several years with no liquid carry-over. They operate on the principle of centrifugally removing solid and liquid contaminants from gas, a method in use for many years in dust control.

Aerotec Dry Gas Scrubbers are serving the industry on practically every major gas line today. Their outstanding performance presents an unexcelled record and their comparatively small size simplifies installation in limited space.

Our Project Engineers have a background of experience in solving gas scrubbing problems that will be valuable to you.

Project Engineers **THE THERMIX CORPORATION** Greenwich, Conn.
(Offices in 38 principal cities)
Canadian Affiliates: T. C. CHOWN, LTD., 164 Metcalfe Ave., Westmount, Montreal 6, Que.

Manufacturers
THE AEROTEC CORPORATION
Greenwich, Conn.

Westcoast offering new $25 million issue

Eastman Dillon, Union Securities & Co. heads an underwriting group offering a new issue of $25 million (U. S.) Westcoast Transmission Co. 5½ per cent subordinate debentures, series C, due 1988.

The underwriters are offering in the U. S. a total of $12.3 million of the debentures. The price per $100 principal amount of debentures of $104 (U. S.) plus accrued interest.

In Canada, a group of underwriters and dealers is offering $12.7 million of the debentures at $100 (Canadian) plus accrued interest per $100 principal amount of debentures.

FPC approves Transco's $53 million construction

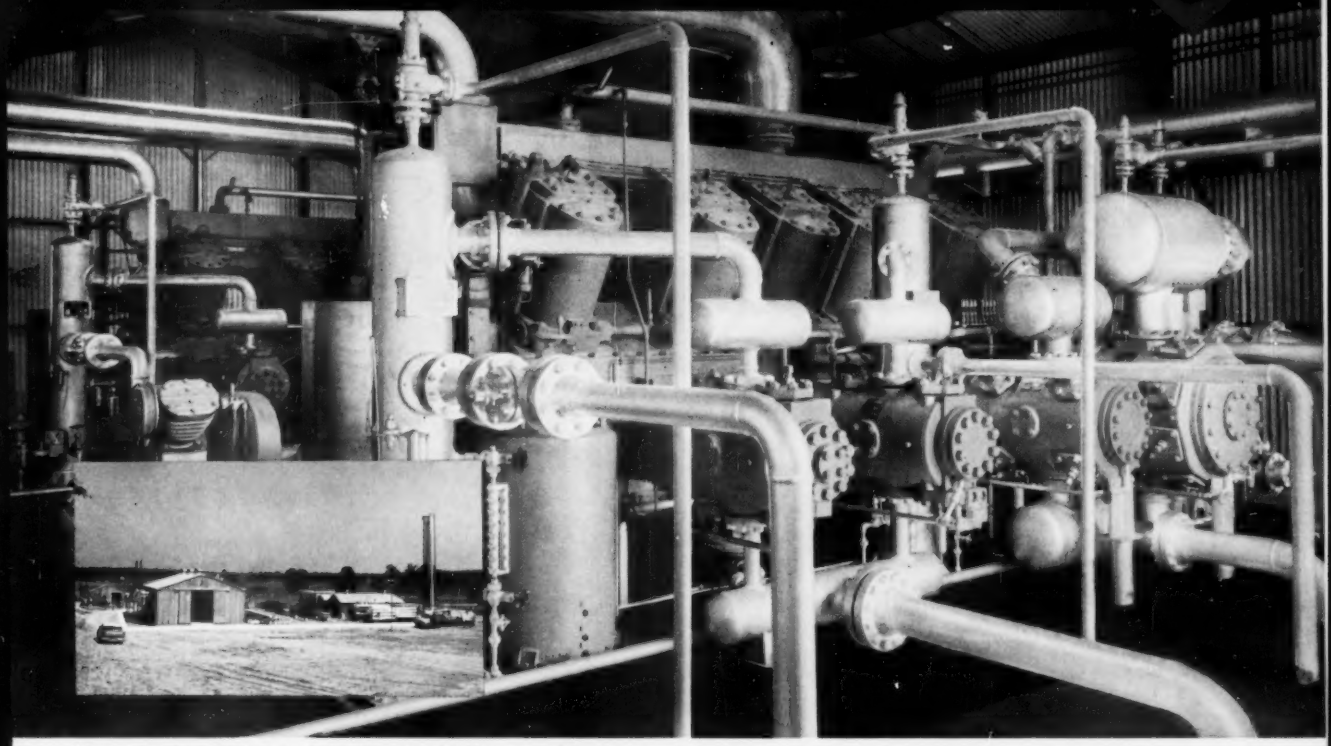
Transcontinental Gas Pipe Line Corp., Houston, won FPC approval of its plan to spend about $53.7 million to add 132.8 MMcf/day to its firm delivery capacity.

At the same time, Presiding Examiner Emery J. Woodall authorized Eastern Shore Natural Gas Co., Salisbury, Md., to build 124 miles of transmission line and appurtenant facilities to cost about $3 million—which will serve the eastern shore areas of Delaware and Maryland.

Eastern Shore will receive gas from Transco.

Transco will build its facilities in Texas, Louisiana, Mississippi, Alabama, Georgia, South Carolina, Virginia, and Maryland. The facili-

BEAIRD-INGERSOLL-RAND Packaged Compressor Plant



Tatum Gas Plant equipped with two Beaird-Ingersoll-Rand 10SVG 550 h.p. packaged compressors. Units are complete with all necessary controls for unattended operation. Other sizes from 120 to 660 h.p.

Packaged Compressor Equipped . . .

GAS PROCESSING BOOSTS FIELD ALLOWABLES

Robert Cargill, operates this gas processing plant in the Tatum-Petit Field. Located just outside the city limits of Tatum, Texas, the field has grown from a single wildcat to 75 producing wells in less than three years. During this swift expansion it became evident that the increasing number of high gas-oil ratio wells would curtail oil production unless a means was provided to conserve the excess gas. An additional problem was created by the wide variation of wellhead pressures which ranged from 25 psig. to 650 psig.

Engineers called in by Robert Cargill solved the production problem by designing a gas processing plant to remove heavy elements as marketable by-products and to boost the dry gas to a nearby sales line. Two Beaird-Ingersoll-Rand 10SVG 550 horsepower packaged compressors were selected for the main station. Each compressor has been engineered to handle both low and high pressure streams. Low pressure gas is boosted through three compression stages then tied into the discharge of the fourth cylinder which boosts the high pressure stream. The plant can process 20 mmcfd. at 850 to 1,000 psig. discharge with its present arrangement.

As future requirements demand, additional packaged units may be economically installed to handle the increased load. When the field is depleted the compressors may be moved to other service with little or no change in piping or manifolding.

Let us assist you in planning an economical solution to your production problem. Call or write . . .

THE J. B. BEAIRD COMPANY, INC.
Shreveport, Louisiana
A Subsidiary of American Machine & Foundry Company

BEAIRD
another AMF product
PACKAGED COMPRESSOR PLANTS

LOWEST COST PER HORSEPOWER INSTALLED

SHREVEPORT, LOUISIANA. *Sales Offices: Dallas, Houston, Corpus Christi and Midland, Texas • New Orleans, Louisiana • Tulsa, Oklahoma • Denver, Colorado • Los Angeles, California • Caracas, Venezuela • Cie. Ingersoll-Rand, Paris, France.*

ties are divided into two sections: Part 1, considered by Transco to be mainline facilities, includes 112 miles of 36-in. and 30-in. loops; 12 miles of 24-in. Louisiana purchase lateral loop; 32,500 hp in three new stations; 4000-hp additions to existing station; and miscellaneous equipment.

Part 2, gas supply or purchase facilities, consists of 15 miles of 30-in. mainline loops; 246.9 miles of various size purchase laterals; 18,640-hp additions at three existing compressor stations; a new gas gathering meter station; eight new dehydration stations; and wellhead meters. These facilities will enable Transco to tie-in major new gas reserves in the West Big Foot area in McMullen, Frio, and LaSalle counties, Texas.

Transco will use the new facilities to increase service to 17 existing customers and seven new customers. Initially, Transco proposed service to four new customers: Atlantic Seaboard Corp., 15 MMcf/day; Manufacturers Light & Heat Co., 10 MMcf/day; Eastern Shore, 5 MMcf; and Central Virginia Gas Co., 1.3 MMcf.

Los Angeles county sheriff, Eugene W. Biscailuz (left) and F. S. Wade (far right), chairman of the board of Southern California Gas Co., turn giant valve dedicating new $33.5 million line which released more than 200 MMcf of gas into southern California from mid-continent sources. Looking on are F. M. Banks (2nd from left), president and general manager of Southern California Gas Co., and Guy W. Wadsworth, Jr., president and general manager of So-Counties. With opening of the valves, the new gas set a record high of more than 1 billion cu ft of gas coming into the area from out of state. Ceremonies took place at Newhall, Calif.

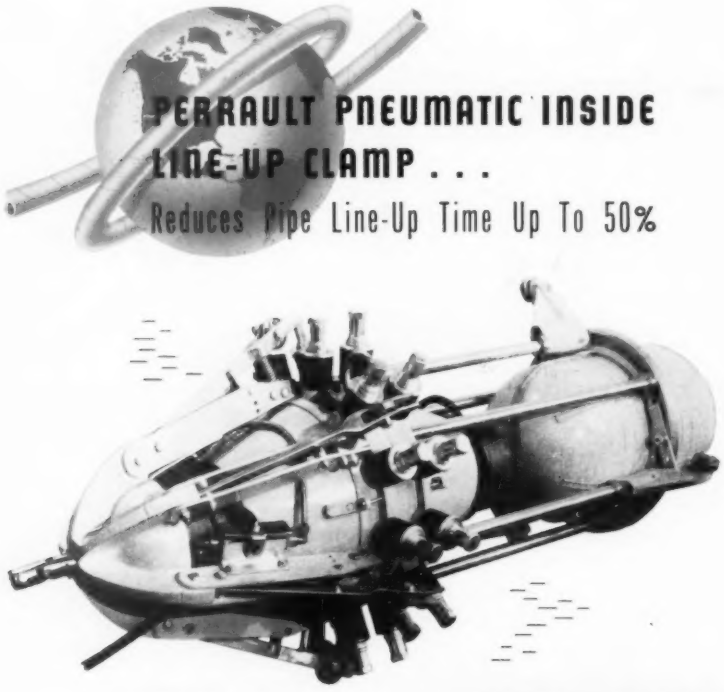
However, the examiner ordered Transco to allot the third year's requirement of 8.6 MMcf/day, to Eastern Shore, with Eastern Shore being required to take only 5 MMcf/day the first year unless it elects otherwise. In addition to its own gas, Eastern Shore will transport 4 MMcf/day for Delaware Power & Light. The gas will be purchased by Delaware from Transco.

The transmission company was also ordered to provide 701 Mcf daily to Bessemer City, N. C.; 1.3 MMcf daily to Cherryville, N. C.; and 1096 Mcf/day to Woodruff, S. C.

Transco will also provide an interruptible transportation service to Virginia Electric Power Co. in daily volumes up to 25.5 MMcf. This transported gas will be bought by VEPCO from Union Oil.

Transco signs contracts for 68 MMcf/day delivery

Transcontinental Gas Pipe Line Corp. has signed new contracts calling for a minimum purchase of



PROVED IN 27 COMPLETED PROJECTS

Has now been used by major pipeline contractors in all areas; coast-to-coast, and from Mexico into Canada on lines for some of the world's most important pipeline companies. Speeds jobs because air-operated studs bring pipe into true round without hi-lo hammering; makes good stringer beads quick and easy. Rental basis: For pipe sizes from 20" thru 36". More details? Call Perrault.

Everything For The PIPELINER

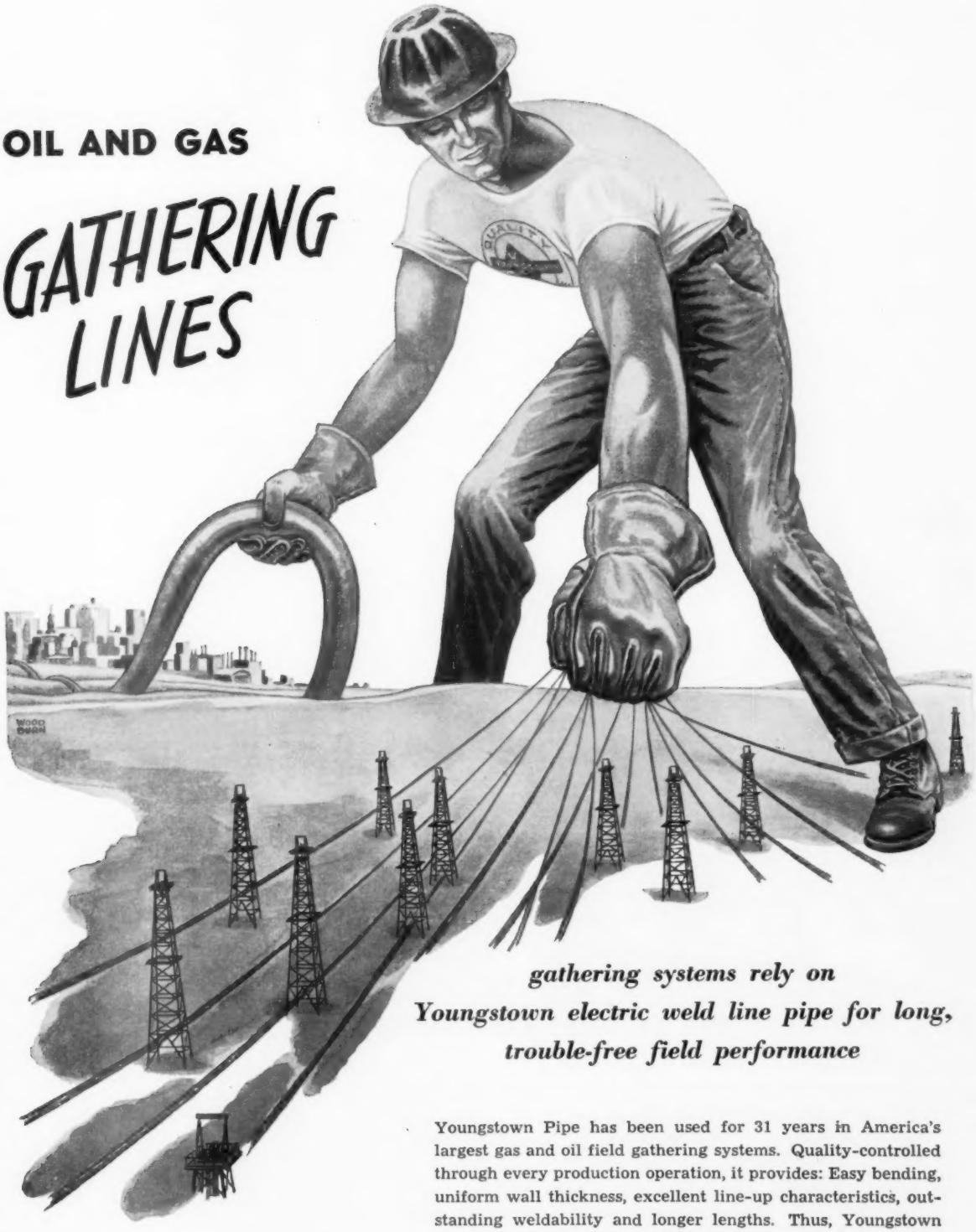
Coating and wrapping and cleaning and priming machines — line traveling or stationary. Glass Pipe Wrap, Asbestos Felt Wrap, Kraft Wrap, and Rock Shield. Tar-Heating Kettles, Burners, Patch Pots and Accessories. Pneumatic-Tired Lowering-In Cradles, Adjustable Pipe Cradles, Five-roller Cradles, Tongs, Hooks, Blocks, Belts, Slings, Line-up Clamps, Hand Tools, Supplies and Equipment of every sort.

PERRAULT **EQUIPMENT** COMPANY

1130 N. BOSTON — TULSA, OKLA. — TELEPHONE LUther 5-1103

OIL AND GAS

GATHERING LINES



gathering systems rely on Youngstown electric weld line pipe for long, trouble-free field performance

Youngstown Pipe has been used for 31 years in America's largest gas and oil field gathering systems. Quality-controlled through every production operation, it provides: Easy bending, uniform wall thickness, excellent line-up characteristics, outstanding weldability and longer lengths. Thus, Youngstown Line Pipe speeds and simplifies the laying of gathering lines.

THE YOUNGSTOWN SHEET AND TUBE COMPANY
Producers of Carbon, Alloy and Yoloy Steels
General Offices - Youngstown 1, Ohio
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68 MMcf/day from seven Louisiana fields.

Transco's president, E. Clyde McGraw, said that the new supplies will be added to the company's system as soon as a certificate is received from the FPC and construction of the proposed facilities is completed.

Although the contracts provide for a minimum purchase of 68 MMcf/day during the first year, capacity of the new supply system will be 222 MMcf/day. Substantial undeveloped reserves exist in the area and anticipated additional volumes of natural gas dictate the extra line capacity. The proposed supply system will cost a little more than $14 million.

Mr. McGraw said that 65 miles of 24-in. lateral will extend almost due south to the Mississippi river from a point of connection with Transco's mainline in St. Helena parish on the Louisiana-Mississippi border. The 24-incher will span St. Helena, Livingston, Ascension and St. James parishes. A multiple crossing will be built under the Mississippi river near the town of Convent.

South of the Mississippi, 22 miles of additional 24-in. lateral is planned. Smaller laterals, 10 in. and 6 in., will extend into the seven fields.

CIG connects new Oklahoma reserves

Facilities have been completed connecting gas reserves in the Mocane and Laverne areas of western Oklahoma to Colorado Interstate Gas Co.'s transmission system. More than 850 billion cu ft of gas are involved.

At present 22 wells in the Laverne area are tied to CIG's system while 69 wells in the general Mocane area are also linked with the system. Based upon current drilling programs of suppliers, Vice President S. Cassell Barrett reports a total of 44 additional wells in the Laverne area and 95 additional wells in the Mocane area are scheduled for connection within the next year.

Next step in the further development of these areas will come with the construction of a mainline plant at Mocane for the extraction of natural gasoline and other liquefiable hydrocarbons. Colorado Interstate has entered into an agreement with Sunray Mid-Continent and Warren Petroleum for construction of the plant. It is expected to be in operation by late fall in 1958 and be capable of processing about 100 MMcf/day.

Decision reversed, sale to El Paso okayed

Reversing an examiner's decision, the FPC has granted a certificate to Continental Oil Co., Houston, covering continued sales to El Paso (Texas) Natural Gas Co. from a single well.

The commission said that the issue involved was whether this transaction brings Continental within the jurisdiction of the Natural Gas Act. If the Act creates such jurisdiction, the FPC said, it is undisputed that a certificate should be issued on the basis of the record.

Delivery of the gas takes place at the point where the facilities owned by Continental—casinghead, bleeder valve, and two master valves—end and the facilities owned by El Paso begin; namely,

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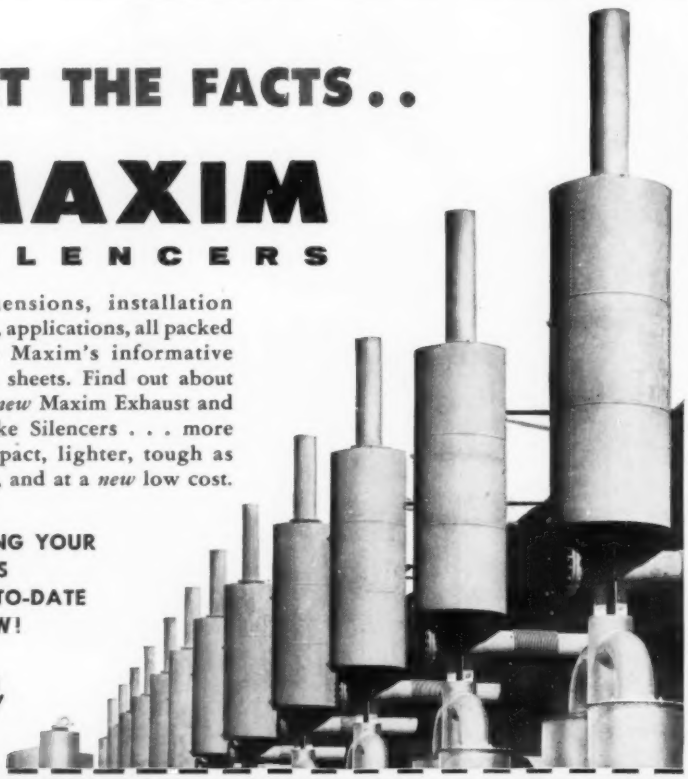

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Any of the Dow magnesium anode distributors listed below can give you more information. Contact the one nearest you or write directly to us. THE DOW CHEMICAL COMPANY, Midland, Michigan, Department MA 1429JJ-2.

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pipeline news • *Cont'd.*

at the point where the gas enters a reducing swage at the top of the Christmas tree. While Continental's valves are not utilized to control the rate of flow, the commission said, they could be operated to discontinue completely the sale of gas to El Paso, thereby ending service. It had been claimed that El Paso produced the gas because it controlled the rate of gas flow at the metering point.

Basically, the evidence demonstrates, the FPC said, that natural gas produced by Continental is sold to El Paso and delivered into El Paso's interstate system.

West Virginia storage planned by Equitable

Equitable Gas Co., Pittsburgh, wants to develop the Rhodes natural gas storage pool in Lewis county, W. Va.

In its application filed with the FPC, the company says the job would include construction of 11.7 miles of storage pipeline, drilling 40 wells, and construction of a dehydration plant for an estimated $2 million.

The proposed storage pool is at present a nearly exhausted gas pool, consisting geologically of three separate pools. Equitable proposes to inject approximately 1.1 billion cu ft into one of the pools during 1957 and to develop the remaining two areas upon completion of the first.

El Paso's new research lab gets under way

Work is getting under way on the $200,000 research laboratory that El Paso (Texas) Natural Gas Co. is building adjacent to the campus of Texas Western College.

In announcing the plans for the laboratory earlier this year, El Paso's Paul Kayser pointed out that the company needed additional room for more efficient operation of its research department and for further expansion. "The object of placing the building adjacent to the college is to take advantage of the cooperation of the college in scientific work that is carried on from time to time," he said.

He added that there is an "area of cooperation that can be mutually profitable both to the college and to the company."

The new research lab will be erected on a two-acre site. It will contain up to 12,000 sq ft of space. Both chemical and mechanical research, aimed at improving the efficiency of various equipment and material used in El Paso's pipeline system, will be conducted in the laboratory.

Mineral resources branch has new director

Royce A. Hardy Jr., a Nevada mining expert, is the new head of the Interior Department's mineral resources branch, which includes the Office of Oil and Gas.

Mr. Hardy, 36-year-old general manager of Manganese Inc., at Henderson, was named by President Eisenhower to succeed Felix E. Wormser to the post of Assistant Secretary of Interior for Mineral Resources.

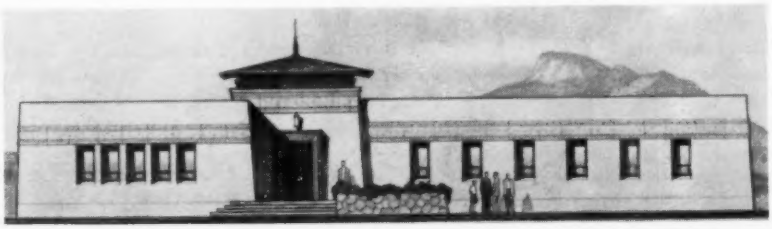
The Hardy appointment is subject to confirmation by the Senate when Congress reconvenes next January.

The new assistant secretary, a Republican, will also have charge of the Bureau of Mines, the U. S. Geological Survey, the Office of Minerals Mobilization, the Defense Minerals Exploration Administration and the Division of Geography.

GAS pipeline notes

Peace River Natural Gas Co. Ltd. shareholders have approved the merger of Peace River and Westcoast Transmission Co. Ltd. The merger makes Westcoast an

El Paso Natural's new $200,000 research lab is being erected adjacent to the campus of Texas Western College in El Paso.



This job called for speed!

GYRO-FLO 85 saves time as contractor changes underground tanks at 40 gas stations

Sunoco's new variable octane gasoline required new underground storage tanks at the forty service stations in the vicinity of Newburgh, N.Y. Contractor Ira D. Conklin and Sons was told that each installation had to be *fast*. None of the stations could be shut down during the work... gasoline trucks were actually standing by to fill the new tanks as they were lowered into their excavations.

Since it was necessary to make fast moves with men and equipment from station to station on heavily-traveled streets, the contractor used the highly-portable Gyro-Flo 85 as his primary source of air power. This portable—the only rotary built in the 85-cfm size—provided air for diggers and paving breakers during excavation.

At one station heavy rainstorms caused flooding of an excavation that had already been prepared. A hurry-up call was put through for the Gyro-Flo 85 working at a station some distance away. The compressor was rushed to the scene, hooked up to an I-R sump pump, and dewatering was accomplished while the tank was being lowered into its excavation.

Meeting tight deadlines is a Gyro-Flo habit: the lightweight model 85 matches the larger Gyro-Flo models (up to 900-cfm) in the essential element of dependability under the most demanding job conditions. Ask your I-R distributor for details or write for form 2307.

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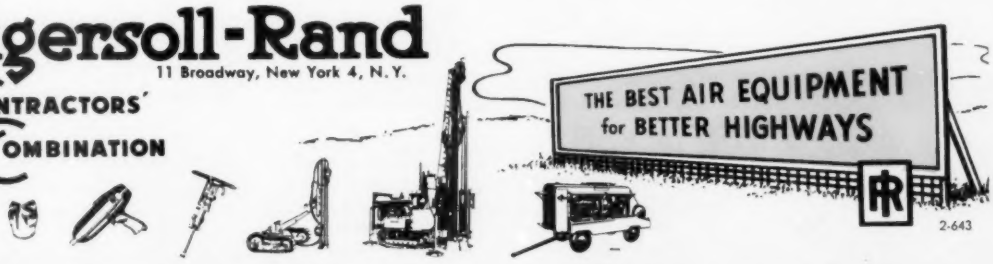
CONTRACTORS' COMBINATION



AN UNBEATABLE COMBINATION... GYRO-FLO COMPRESSORS AND I-R ROCK DRILLS

integrated company with large land holdings and important gas reserves in addition to its gas transmission system. Peace River has interests in 2.3 million gross acres, mainly in northeastern British Columbia.

The Tube Turns division of National Cylinder Gas Co., Louisville, Ky., plans to increase its manufacturing area approximately 40 per cent by converting buildings on property adjacent to its main plant. A $400,000 construction project contract has been signed whereby three existing buildings will be connected, thus creating a new manufacturing area under one roof.

The 1956 edition of "Statistics of Natural Gas Companies" has been published by the FPC. Information on 107 companies is included. Copies of the publication are available from the FPC, Washington 25, D. C., for $3.25 per copy. Order number is FPC S-126.

Operations got under way last month at the Youngstown Sheet & Tube Co.'s new seamless tube mill in East Chicago, Ind. The new mill is the latest step in a continuing expansion program at the Indiana Harbor Works. An outstanding feature of the new mill is the giant rotary furnace, used to heat billets before they are fed into the piercing mill. It is capable of handling a larger tonnage of billets than any rotary furnace ever before built, according to the company.

The FPC recently issued certificates to:

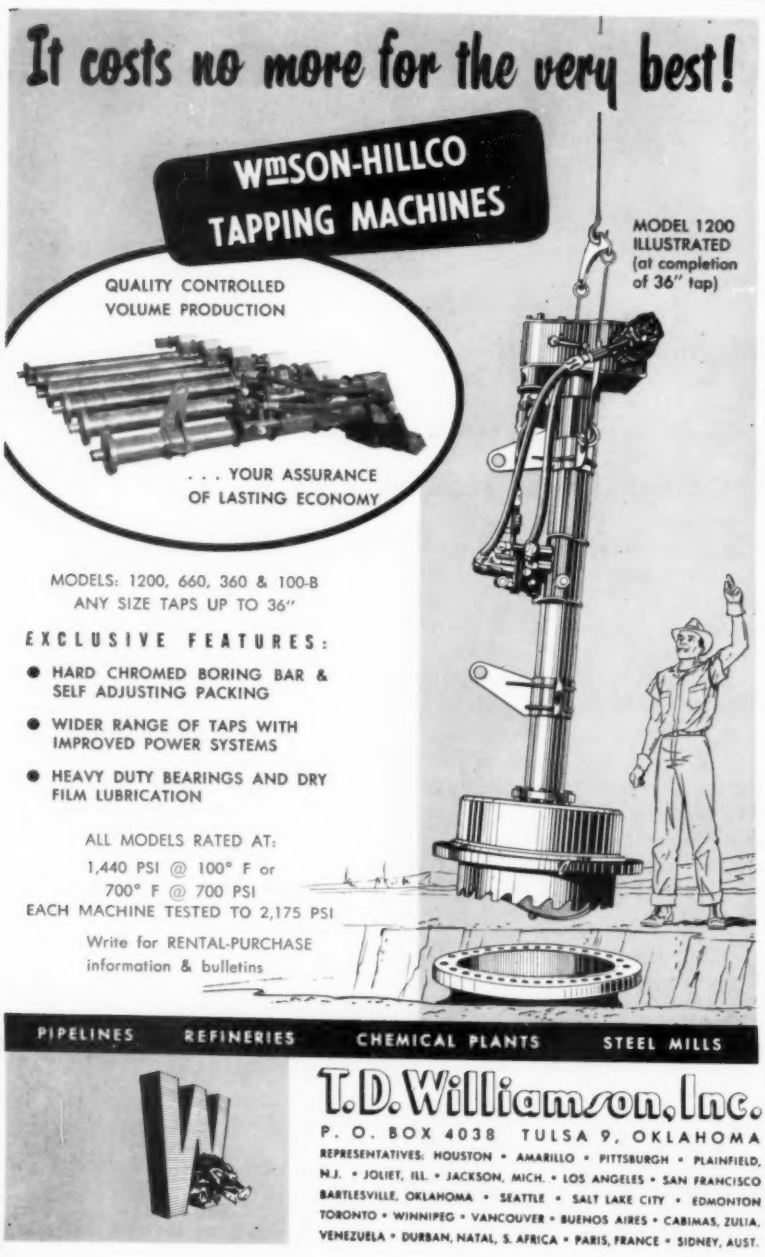
Ohio Fuel Gas Co., Columbus, for 33 miles of line to meet increasing market requirements. The new line, costing about $1.2 million, will go into Lorain, Belmont, Guernsey, Champaign, Logan, Greene, Clark, Madison, Fayette, Licking and Richland counties.

Ohio Fuel Gas Co., Columbus, to spend approximately $1.5 million for new facilities in Montgomery, Holmes, Wayne, Stark, Carroll, Morrow and Marion counties. OFG will construct about 21.8 miles of 12¾- and 20-in. line.

Manufacturers Light & Heat Co., Pittsburgh, to construct $757,300 worth of facilities in Ohio and West Virginia. The company's application said the 13 miles of line are necessary because of pending highway and dam construction in Ohio.

Transcontinental Gas Pipe Line Corp., Houston, for 43.6 miles of 30- and 36-in. loops at a cost of $6.3 million. Transco said the additional looping, a small part of the total construction on which hearings were concluded in August, will raise its total capacity from 877 MMcf to a required 921.7 MMcf.

Michigan Gas Storage Co., Jackson, to construct and operate facilities in central Michigan at an estimated cost of $2.4 million. Thirty-eight hundred horsepower will be added to its Muskegon river compressor station, increasing its capacity to 25,200 hp, and will improve its Winterfield and Cranberry Lake storage fields by drilling new wells, constructing about six miles of 6- to 8-in. gathering pipeline and various 4-in. well lines.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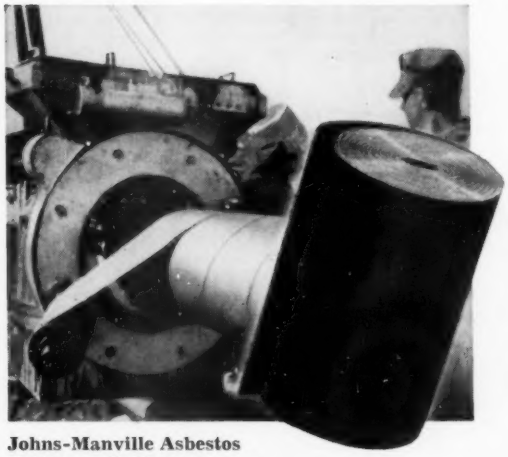

Johns-Manville Asbestos Felt is available in 3 types for field application or mill wrapping:

#15 Asbestos Felt—the high-strength, uniform asbestos wrap that has given superior protection to pipe coatings for more than 30 years—under the most severe soil conditions.

#15 Transhield®—heavyweight asbestos felt with parallel glass reinforcement for high tear strength.

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J-M Asbestos Wrap provides the strong protection a strong coating deserves and needs. It offers the most effective single protection against damage—prolongs the working life of the pipeline coating. Here's why:

Asbestos is an ageless mineral . . . the fibres are strong and tough—cannot rot or decay. As used in J-M Wraps, the asbestos fibres are felted, then impregnated with a cold tar or asphalt saturant to form literally a flexible covering of stone. Like the "dillo's" tough shell that shields him so well—the enduring, "stonelike" J-M Asbestos Wrap shields pipeline enamels from earth loads, soil stress, and other forces that weaken coatings and permit corrosion of the pipeline.

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The operator is now delivering pipeline specification gas to the pipeline company at flow rates up to 180 MMSCFD. Pipeline company is pleased and has noted increase in existing capacity due to removal of water vapor. When asked about the operation of the equipment, the operator said, "It operates itself."

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